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The Elements of Production Grinding

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Grinding the oldest of arts—First grinding wheels natural stones—Sand and emery early grinding mediums—Artificial abrasives—Development of production grinding—The first of several articles

GRINDING as a means of shaping materials of a refractory nature is probably the oldest mechanical process in the world. Long before primitive man had learned the art of making cutting tools of metal, he had found that by rubbing one stone upon another he could fashion sharp points to tip the arrows upon which he depended for a supply of food, and could shape the crude stone axes that enabled him to hew down trees to provide shelter for his family, or, mayhap, to lop off the head of an unfriendly neighbor whose proximity rendered his continued existence a matter of conjecture.

Grinding by rubbing the object to be shaped upon a stationary grinding medium is, however, a tedious process and one in which the product is much more likely to be influenced by the operator's patience than by his skill. Though it is still practised for the purpose of removing minute quantities of materials (we now call it lapping) it was not until man discovered that by making his grinding stone round, mounting it upon a shaft and setting some one of his stalwart offspring to turning it by means of a crank, grinding could be considered more than a makeshift and time-consuming artifice.

Since the days of the first circular grindstone, which probably demonstrated its usefulness about the time that Tubal Cain set up his first forge "under the spreading chestnut tree" and proved that he could more easily fashion metals into shape by heating them red-hot and pounding them, grinding has been looked upon almost solely as a means of putting the finishing touches upon an article already carried as near to completion as possible by other arts, and it was not until comparatively recent years that the abrading process has received consideration as a means of removing amounts of metal larger than were necessary to provide a finished appearance or to make a sharp edge.

Something besides a round grindstone was necessary, however, to make possible the present day rapid production methods of grinding. Even had the machines been available, no stone, however hard and close grained or free from flaws, could withstand the speeds and pressures now common, and it was not until hundreds of years after artificial grinding wheels of a sort had become available, that the proper medium was forthcoming.

Sand, emery, corundum, and a few other miscellaneous materials have been known as abrasives from the earliest times, and up to no longer than thirty years ago were the basis of nearly all mediums used in the industries for grinding and polishing. In fact so recent have been the discoveries of artificial abrasives and so rapid the advance in the art of grinding that to most people not directly connected with our industry anything except a grindstone that is round and used for grinding is an "emery wheel," notwithstanding the fact that wheels of real emery are now seldom found outside of a museum.

Early grinding wheels were made by turning a disk of wood to about the right size, covering the periphery

ALTHOUGH the art of grinding is older than history, its development and application have been more rapid and extensive during the last thirty years than in all previous time. As a purely production process it could never have been developed to the extent to which it is now practiced without the extraordinarily hard mineral substances known as silicon carbide and aluminous oxide. Nor could these substances, even had they been known years earlier than they were, been produced in quantities and at a cost that would render them commercially possible without the electric furnace and the development of vast water powers to provide the electric energy necessary to operate it.

with a strip of leather stretched tightly around and nailed or pegged to the wood and affixing the grains of abrasive to the leather by means of glue or cement. Such wheels were the logical successors of the natural grindstone and in many industries they rapidly supplanted the latter for the reasons that they were inexpensive to make, easy to handle, capable of much higher speeds and consequently more rapid in production.

Another advantage was that the abrasive surface, when worn through, could be restored quickly and without difficulty by merely washing off the remaining grains with warm water and applying fresh abrasive. Many such wheels are now in every-day use, but the advent of the modern grinding wheel has relegated them to a class by themselves and they are of service only for *polishing;* an operation that is distinctly different from grinding.

Further Evolution of the Grinding Wheel

The next step in the evolution of the grinding wheel was the "solid" wheel, made by mixing glue, shellac, rubber, silicate of soda or other sticky materials with the abrasive grains and molding the pasty mass into the shape of wheels, which were then dried, baked or "cured" in accordance with the nature of the bonding medium. All of the above kinds of wheels are in use today, but, with the exception of the silicate wheel, their range of usefulness is confined to specific classes of work where the important desideratum is other than the rapid removal of metal, and they, also, can hardly be classed as "grinding" wheels.

Up to about fifty years ago, such wheels as we have

FIG. 1—SILICON CARBIDE FURNACE

enumerated above were the only kinds available for grinding purposes, and none of them would *grind* as we now understand the term. The art of production grinding was *not*, however, waiting for some one to invent a real grinding wheel—it had not itself been conceived. Practically all grinding was done by what we now call the "off-hand," or "free-hand" method, in which the work is held in the hands of the operator and manipulated in contact with the revolving wheel.

The originator of the grinding machine was probably some careless "jour" who found that after hardening a piece that he had already finished on the lathe it would not go into the place for which it was intended, so he took it to the "emery-wheel" and endeavored by turning it in his fingers before the wheel to reduce it to the proper dimensions before the boss found him out.

However it may have been, it was not until about 1860 that record is found of a machine built especially for the purpose of reducing the dimensions of hardened work to what were then considered to be exact sizes.

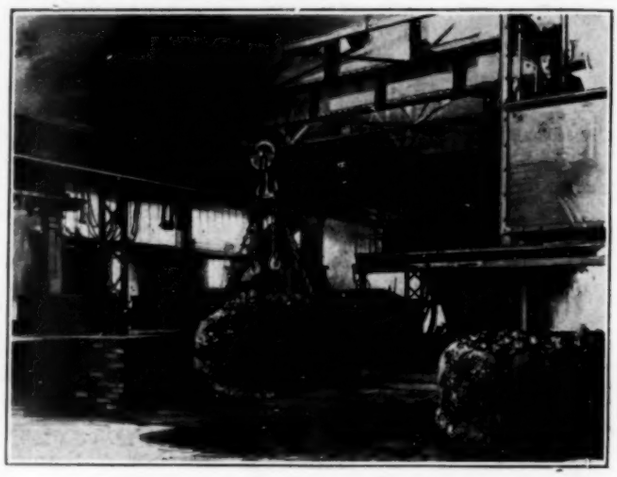


FIG. 2—PIGS OF ALUMINOUS OXIDE

This machine was, naturally, rather a make-shift affair, constructed in part from other machines, but it contained the germ of the grinding-machine idea.

At about the same time J. R. Brown & Sharpe, Providence, R. I., began experiments along the line of accurate grinding, and in 1864 there was in their shop a machine that embodied the principles of the now well-known universal grinding machine. To Brown & Sharpe then, belongs a great deal of the credit for the development of the modern art of grinding.

During the latter half of the nineteenth century the improvement in machines, the addition of features and the devising and adapting of mechanical movements to increase their field of usefulness were fairly continuous, but during that period the conception of the art of *grinding* did not change. Thirty years ago we were using cylindrical, surface, disk and universal grinding machines; but mainly for the purpose of correcting the warped and crooked surfaces left upon most of our tool-steel parts by our then somewhat crude methods of hardening, and then only because the grinding wheel was our sole means of working hardened steel.

The grinding machine was essentially a toolroom proposition, removing minute quantities of material in a slow and tedious manner. Rarely was a lubricant used to keep down the temperature of the work, and if an ambitious operator endeavored to make time in finishing a piece of work he was likely to find that his zeal had caused more damage than his efforts had accomplished good in the way of desirable results.

It is quite probable that had some genius conceived the idea about, let us say, 1890, of building a grinding machine for the sole purpose of removing metal that was quite soft enough to be *cut* with a steel tool, and had proposed to use such a machine as a substitute for the lathe, he would have been thought crazy. And it is more than probable that had he succeeded in building such a machine he would but have proved the conten-

tion of his critics, for the reason that there were no "emery wheels" capable of doing the work.

Up to this time the most commonly used abrasives were emery and corundum, two minerals—or rather, two forms of the same mineral—to be found in nature. Neither is, comparatively speaking, very hard, and what is of even greater importance, neither can be depended upon to preserve a uniform degree of hardness. Nor were the bonds used to hold the wheels together much more dependable. Before the grinding wheel could take its proper place in the mechanic arts as a true cutting tool possessing definite and controllable characteristics, two things were necessary: an extremely hard and uniform abrasive, obtainable in unlimited quantities; and a bond strong enough to withstand the bursting strains induced by rapid rotation, yet sufficiently porous and friable to allow the grains of abrasive to be torn away as soon as their cutting edges become dulled and of no further service.

In the last decade of the nineteenth century both these important requisites were on the way. Vitrified emery wheels, made by mixing the grains of emery with feldspar and various clays and firing the molded wheels in kilns similar to those used for firing pottery, had been on the market for some years. In the early nineties, Dr. Edward Acheson first succeeded in producing silicon carbide, a chemical compound of extra-

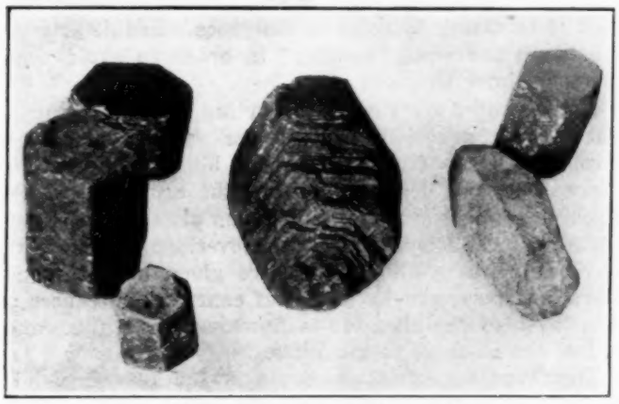


FIG. 3—CORUNDUM CRYSTALS (NATURAL ALUMINOUS OXIDE)

ordinary hardness, to be followed a few years later by the Electro-Chemical Co., whose experiments resulted in what is now known as the aluminous oxide abrasives, of very different chemical constituency but almost equally hard.

TRADE NAMES OF SILICON CARBIDE

Calcinite	Carbolite	Electrolon
Carbolon	Carbowalt	Lotens
Carbolox	Crevorundum	Natalon
Carbonoid	Corex	Silexon
Carbona	Cresolite	Staralon
Carborundum	Crystolon	Sterbon

TRADE NAMES OF ALUMINOUS OXIDE

Alowalt	Borolon	Oxaluma
Aloxite	Clevite	Oxylum
Aluminoid	Excelite	Rex
Alundum	Hytens	Rexite
Bathite	Natalite	Staralox
Boro-Carbone	Orelite	Sterlite

Though the names under which they are known to the trade are legion, these two artificial abrasives are the basis of practically all wheels used in the production grinding of metals. Corundum, the natural mineral, is still extensively used in other industries, particularly in the grinding of glass, to which its nature renders it peculiarly adaptable.

The raw materials of which silicon carbide is made are coke and sand, while aluminous oxide abrasives owe their existence to a soft clayey mineral called "bauxite," none of which materials would seem to the uninitiated to be a very promising basis from which to produce anything so hard. Though both are the product of the

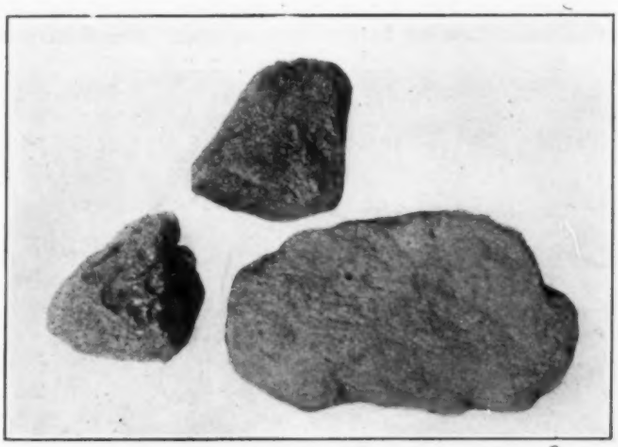


FIG. 4—ARTIFICIAL ALUMINOUS OXIDE

electric furnace, they are made by very different methods.

The silicon carbide furnace, Fig. 1, is of the resistance type, having heavy carbon electrodes permanently mounted in the end walls. When filling the furnace with the charge of raw material a core of granular carbon is laid through the center of the charge to conduct the current from one electrode to the other.

As it emerges from the furnace, the resultant mass is roughly cylindrical in shape and is composed of crystals of silicon carbide at the center, surrounded by material that has been but partially reduced. The

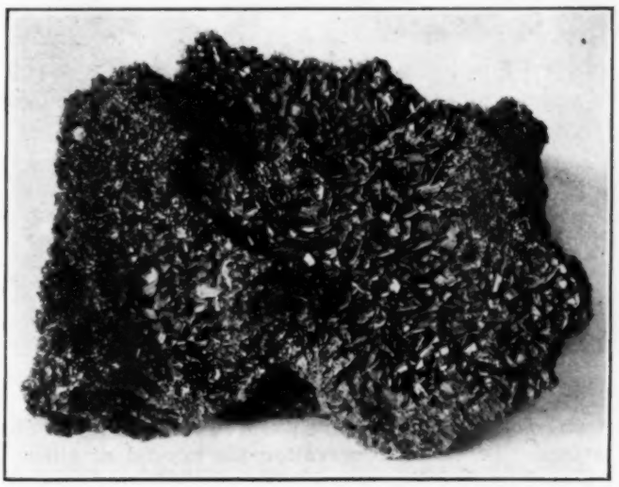


FIG. 5—SILICON CARBIDE CRYSTAL

action is less and less apparent as the radial distance from the central core increases, until at the outside the cylinder consists largely of unconverted material.

These cylinders exhibit comparatively little homogeneity and are easily broken up, after which the unconverted and partly converted material goes to other

furnaces for further treatment while the crystals of silicon carbide pass to the crushers to be reduced to grains.

Aluminous oxide is produced from the bauxite in cylindrical steel furnaces by the heat of the electric arc and the resulting mass is in the form of a single pig, very hard and tough and quite difficult to break in the preliminary stages of crushing. Fig. 2 shows the pigs as they are taken from the furnaces.

Crystals of corundum (the natural aluminous oxide) are shown in Fig. 3. As has previously been stated, large quantities of corundum are used in industries

FIG. 6—THE CRUSHING PLANT

that involve polishing and grinding operations upon materials other than metal, but as corundum does not properly enter into the field of production grinding as we are interested in it, we will give it no further consideration here.

The artificial aluminous oxide, Fig. 4, is of a reddish

FIG. 7—A VIEW IN THE GRADING ROOM

brown color, ranging to pure white in some of its modifications. To casual observation the crystal of silicon carbide, Fig. 5, will appear black, but close examination will show it to be a dark green, with sometimes a bluish cast, depending upon its origin.

A partial view of a crushing plant is shown in Fig. 6. It is automatic in its operation and though this particular plant occupies an equal space on the floor above the one shown in the picture, it requires the services of but one operator and a helper. The crystals of abrasive are fed first to a jaw crusher and from thence

FIG. 8—ONE OF THE GRADING MACHINES

forward the product of the various machines is transferred to the next succeeding one by belt conveyors until the granulated material is finally delivered by the same means to the washing and drying room.

The term "grading" is applied to the sorting of the abrasive grains in accordance with their size, but as the term bears no relation to the "grading" of the finished wheels (which is a matter almost wholly concerned with the bonding material) we will, in so far as it is necessary to refer to the process in this article, substitute the word "sorting" in order to avoid confusion in later chapters.

Figs. 7 and 8 are views in a sorting (grading) room. The grains are delivered to the sorting machines through a chute from the storage bins which contain the washed and dried product of the crushers. Each machine contains a series of screens placed at a slight angle of inclination, each screen overlapping the next succeeding one. The screens are given a continuous vibratory movement by means of cams, which causes a thin layer of the abrasive to flow over them from one end of the machine to the other.

The finest screen is, of course, at the incoming end, so that all grains larger than the mesh of this first screen pass over it to the screens beyond while the grains that correspond in size to the mesh drop through into receptacles beneath. Thus the grains are sorted out progressively; only the larger ones reaching the end of the machine, where they are transferred by belt conveyors to an adjoining machine upon which they enter a continuation of the sorting process.

FIG. 9—WASHING AND DRYING THE ABRASIVE

The screens from number 200 (200 threads to the inch, warp and woof) to number 40 are made of a very fine quality of hand-woven Swiss silk. The silk is stretched tightly over a wooden frame, made to fit in the machine, so that a screen may be changed or different sizes substituted without delay. Screens from No. 36 to 6 are of wire.

Grain size is an important factor in selecting wheels and fortunately it is a very arbitrary designation; quite unlike the "grade" designation, which is a factor of wheel hardness and will be discussed in a later chapter. As has been seen, the grain size is established by the screens, which have an arbitrary number of apertures to the inch and, though there may be slight variations in the weave of the silk or, particularly, in the diameter of the wires in the wire screens, the difference is so small as to be inappreciable.

There are sizes of abrasive grains finer than 200, most makers supplying three grades of "flours," designated as F, FF and FFF respectively. In the mulling process to which the crushed grains are subjected before drying, clear water is constantly flowing into the tubs to be seen in Fig. 8, and as constantly flowing over the sides and running to waste. This escaping water carries a percentage of abrasive in suspension, and as it flows through the tortuous passages to be seen in the foreground of Fig. 9 it is caught by riffles from whence it is taken periodically and sifted through silk of even finer weave than any of the screens of the sorting machine.

For the use of jewelers and others who require an extraordinary fine grain of abrasive it is further separated by flotation. A receptacle is filled with water having the abrasive in suspension, allowed to stand for a definite time and the liquid then decanted. The precipitate is designated as 5-, 10-, or 15-minute powder, according to the length of time allowed for the precipitation to take place.

Proposed Standards for Steel Castings

In the report of the Committee on Steel at the twenty-sixth annual meeting of the American Society for Testing Materials, held at Atlantic City, June 26 to 29, a number of revisions in the standards of the Society were proposed. These included structural steel for locomotives and cars, steel castings, welded- and seamless-steel pipes, structural nickel-steel, open-hearth steel girders and high T-rails, boiler and fire-box steel for locomotives, and boiler-rivet steel.

The sub-committee on commercial bar steel considered the question of the preparation and classification for cold-rolled finished shafting but, finding that this was largely a question of tolerances on the size of the shafting, came to the conclusion that this could best be handled by the Sectional Committee on Standardization of Shafting, which has been organized under the American Engineering Standards Committee.

A new sub-committee on plate tolerance has effected an organization with A. A. Stevenson, as chairman. This committee is at work on the subject of rolling tolerances for plates. It has appointed two sub-committees, one to collect data on plates up to 144 in. in width and the second to collect data toward the establishment of a table of overweight tolerances for plates 144 in. wide and over.

A committee on steel castings proposed tentative specifications for the purpose of eliciting criticism and it is understood that these have not yet become standards of the society, but are subject to revision. Specifications cover two classes of castings, as follows:

Class A, castings for which no physical requirements are specified. Class B, castings for which physical requirements are specified, these being of three grades, hard, medium and soft.

The steel is to be made by one or more of the following processes: open hearth, electric furnace, converter or crucible. Class A castings need not receive any heat treatment unless so specified, or unless the carbon contents exceed 0.30 per cent. Class B castings shall receive a proper heat treatment, depending upon design and chemical composition. Each treatment shall consist of annealing or normalizing.

The specifications concerning workmanship and finish require that:

The castings shall conform substantially to the shapes and sizes indicated by the patterns and drawings submitted by the purchaser, and shall be free from injurious defects.

Defects which do not impair the strength of the castings may be welded by an approved process. The defects shall be cleaned out to solid metal before welding, and when so required by the inspector, shall be submitted to him in this condition for his approval. When required by the inspector, important castings shall be heat treated after welding.

Physical properties and tests are specified for Class B castings only as follows:

The castings shall conform to the following minimum requirements as to tensile properties:

	Hard	Medium	Soft
Tensile strength, lb. per sq.in.	80,000	70,000	60,000
Yield point, lb per sq.in.	0.45 tens. str.	0.45 tens. str.	0.45 tens. str.
Elongation in 2 in., per cent.	17	20	24
Reduction of area, per cent.	25	30	35

No limit shall be placed on the tensile strength in any of the grades. The yield point shall be determined by the drop of the beam of the testing machine. Bend tests shall not be required for castings of the hard grade, and shall be required for castings of the medium and soft grades only when so specified in the order.

When a bend test is specified, the test specimen shall withstand being bent cold without cracking on the outside of the bent portion, around a pin 1 in. in diameter to the following angles:

	Hard	Medium	Soft
Angle of bend	No Bend Test	90 deg.	120 deg.

Exporting From An Inland City

To successfully move goods from interior ports to foreign customers, co-ordination of several different functions is required. All packing, marking and checking systems must be carefully worked out. Few of the men in the inland factories have ever seen tidewater. They do not visualize the handling which goods may receive when flung oversides in an open roadstead where an uncovered lighter rubs up and down alongside, perhaps shipping spray or receiving the tropical downpour until its bottom is awash. The impact of the package coming down with the bottom of the lighter coming up is usually sufficient to make the domestic type of package look very sick indeed.

TABLE XXVI

France—Exports of Machine Tools—"Machines-Outils"

Countries of Destination	1909 Q.M.	1909 Francs	1910 Q.M.	1910 Francs	1911 Q.M.	1911 Francs	1912 Q.M.	1912 Francs	1913 Q.M.	1913 Francs	*1914 Q.M.	*1914 Francs	1915 Q.M.	1915 Francs
Russia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,650	.....
Great Britain	3,771	.....	2,434	.....	3,640	.....	5,700	.....	4,226	.....	.....	.....	3,127	.....
Germany	3,572	.....	3,339	.....	5,117	.....	4,698	.....	2,995	.....	.....	.....	.....	.....
Belgium	19,413	.....	21,206	.....	13,780	.....	16,865	.....	17,376	.....	.....	.....	.....	.....
Greece	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	298	.....
Switzerland	9,585	.....	7,324	.....	4,771	.....	3,377	.....	4,837	.....	.....	.....	2,461	.....
Spain	2,876	.....	1,601	.....	1,885	.....	2,219	.....	3,525	.....	.....	.....	2,515	.....
Italy	8,580	.....	15,663	.....	7,952	.....	4,188	.....	2,904	.....	.....	.....	4,020	.....
Portugal	.....	.....	.....	.....	863	.....	1,199	.....	1,410	.....	.....	.....	406	.....
Morocco	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	207	.....
United States	1,545	.....	2,750	.....	8,203	.....	875	.....	.....	.....	.....	.....	803	.....
Mexico	.....	.....	.....	.....	.....	.....	.....	.....	1,207	.....	.....	.....	.....	.....
Brazil	2,520	.....	3,657	.....	4,418	.....	4,795	.....	9,357	.....	.....	.....	.....	.....
Argentina	5,242	.....	5,686	.....	8,222	.....	9,221	.....	6,784	.....	.....	.....	171	.....
Chile	.....	.....	1,852	.....	.....	.....	.....	.....	1,048	.....	.....	.....	.....	.....
Australia	.....	.....	.....	.....	1,144	.....	2,257	.....	.....	.....	.....	.....	.....	.....
Other foreign countries	5,949	.....	4,985	.....	4,704	.....	4,841	.....	5,820	.....	.....	.....	637	.....
Total foreign countries	63,053	12,925,865	71,497	14,656,885	64,699	13,263,295	60,235	12,348,175	61,489	12,605,245	.....	.....	16,295	10,021,425
Algeria	2,530	.....	3,033	.....	3,995	.....	4,001	.....	3,898	.....	.....	.....	1,464	.....
Tunis	1,416	.....	974	.....	1,515	.....	1,849	.....	3,623	.....	.....	.....	354	.....
Senegal	482	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37	.....
Indo-China	793	.....	605	.....	686	.....	838	.....	856	.....	.....	.....	.....	.....
New Caledonia	318	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Madagascar and Dependencies	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	177	.....
French Guiana	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	41	.....
Other Colonies	850	.....	1,454	.....	1,360	.....	1,029	.....	1,686	.....	.....	.....	81	.....
Total Colonies	6,389	1,309,745	6,066	1,243,530	7,556	1,548,980	7,717	1,581,985	10,063	2,062,915	.....	.....	2,154	1,324,710
TOTAL	69,442	14,235,610	77,563	15,900,415	72,255	14,812,275	67,952	13,930,160	71,552	14,668,160	41,628	8,533,740	18,449	11,346,135
Average Exchange Rates		.193		.193		.193		.193		.193		.199†		.182
Value in U. S. Dollars		2,747,473		3,068,780		2,858,769		2,688,521		2,830,955		1,698,214		2,064,996

Countries of Destination	1916 Q.M.	1916 Francs	1917 Q.M.	1917 Francs	1918 Q.M.	1918 Francs	1919 Q.M.	1919 Francs	1920 Q.M.	1920 Francs	1921 Q.M.	1921 Francs	1922 Q.M.	1922 Francs
Russia	5,983	.....	1,584	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Norway	.....	.....	107	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Great Britain	3,649	.....	2,224	.....	2,088	.....	2,657	.....	8,727	.....	.....	.....	.....	.....
Germany	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Belgium	.....	.....	.....	.....	.....	.....	15,683	.....	21,448	.....	.....	.....	.....	.....
Greece	.....	.....	.....	.....	93	.....	.....	.....	787	.....	.....	.....	.....	.....
Switzerland	5,832	.....	9,574	.....	3,552	.....	3,550	.....	3,684	.....	.....	.....	.....	.....
Spain	1,339	.....	1,980	.....	832	.....	1,769	.....	8,853	.....	.....	.....	.....	.....
Italy	12,373	.....	15,572	.....	8,133	.....	4,973	.....	6,255	.....	.....	.....	.....	.....
Portugal	232	.....	61	.....	100	.....	.....	.....	1,513	.....	.....	.....	.....	.....
Morocco	352	.....	124	.....	919	.....	.....	.....	.....	.....	.....	.....	.....	.....
United States	194	.....	383	.....	109	.....	.....	.....	1,247	.....	.....	.....	.....	.....
Mexico	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brazil	.....	.....	.....	.....	51	.....	.....	.....	1,014	.....	.....	.....	.....	.....
Argentina	130	.....	63	.....	540	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chile	122	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Egypt	459	.....	208	.....	70	.....	.....	.....	1,426	.....	.....	.....	.....	.....
Turkey	.....	.....	.....	.....	.....	.....	.....	.....	778	.....	.....	.....	.....	.....
Roumania	801	.....	.....	.....	.....	.....	.....	.....	8,823	.....	.....	.....	.....	.....
Luxemburg	.....	.....	.....	.....	.....	.....	.....	.....	1,336	.....	.....	.....	.....	.....
Australia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other Foreign Countries	487	.....	250	.....	93	.....	3,012	.....	2,940	.....	.....	.....	.....	.....
Free Zones	102	.....	73	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total Foreign Countries	31,055	19,098,823	32,203	19,804,845	16,580	10,196,700	31,644	21,359,700	68,831	65,974,300	.....	.....	.....	.....
Algeria	894	.....	864	.....	1,470	.....	987	.....	8,007	.....	.....	.....	.....	.....
Tunis	479	.....	223	.....	391	.....	710	.....	1,943	.....	.....	.....	.....	.....
Senegal	.....	.....	.....	.....	42	.....	286	.....	650	.....	.....	.....	.....	.....
Indo-China	60	.....	118	.....	150	.....	897	.....	1,361	.....	.....	.....	.....	.....
New Caledonia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Madagascar and Dependencies	110	.....	245	.....	97	.....	.....	.....	436	.....	.....	.....	.....	.....
French Guiana	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Morocco	.....	.....	.....	.....	.....	.....	1,549	.....	4,446	.....	.....	.....	.....	.....
French Congo	.....	.....	.....	.....	.....	.....	174	.....	663	.....	.....	.....	.....	.....
Martinique	.....	.....	.....	.....	.....	.....	.....	.....	781	.....	.....	.....	.....	.....
OtherColonies	145	.....	253	.....	70	.....	466	.....	584	.....	.....	.....	.....	.....
Total Colonies	1,688	1,038,120	1,703	1,047,345	2,220	1,365,300	5,069	3,421,575	18,871	18,055,050	.....	.....	.....	.....
TOTAL	32,749	20,136,945	33,906	20,852,190	18,800	11,562,000	36,713	24,781,275	87,702	84,029,350	.....	.....	.....	.....
Av. Ex. Rate and Value, U. S. Dollars	.170	3,423,281	.173	3,607,429	.178	2,058,036	.135	3,345,472	.070	5,882,054				

* Detailed returns are not available. † Seven months' average. Q.M.=Metric quintal = 100 kilograms = 220.46 lb

The Sacramento Shop of the Southern Pacific Railway

By FRED H. COLVIN
Editor, *American Machinist*

A railway shop with its own rolling mill—Babbitt hub liners—Welding locomotive frames with oil burners and air hammers

THE MAIN SHOP of the Southern Pacific Railway is at Sacramento, Calif., and dates back something over 50 years. So far as concerns transportation, it was then many miles further from the eastern source of supply than it is at present, which probably accounts for the establishment of its own rolling mill about 40 years ago. This mill is still doing business, rolling much of the material used in car work and for other purposes. A new 6-ton Heroult electric furnace casts steel ingots and also makes such steel castings as driving boxes, truck members and sections of frames

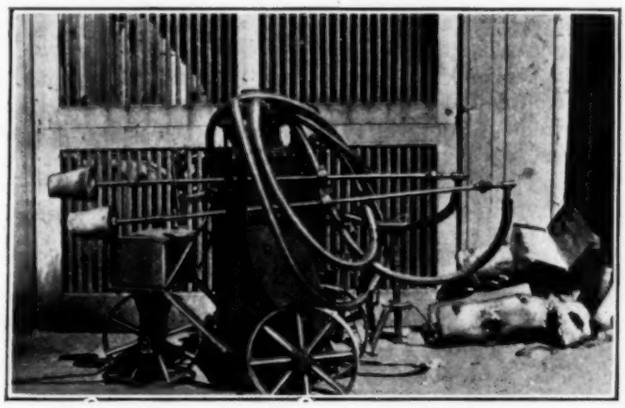


FIG. 1—PORTABLE OIL HEATING OUTFIT

for repair work. Lack of space on the molding floor prevents the casting of complete frames, most of them coming from a steel plant down on the peninsula below San Francisco.

New machine tools are to be found scattered in among the old as in nearly all railway shops. All know the need of newer and bet'er equipment and some of it is on the way. There is a goodly array of Fox lathes, a few with turrets for handling the brass work instead of engine lathes.

Crosshead guides are ground on a ring-wheel machine but grinding has not been adopted for much work as yet. Piston rods and axle journals are finished by rolling.

Hub or lateral wear is taken mostly by heavy babbitt faces on the driving boxes. Care is being taken to use a good, hard babbitt for this purpose, as it apparently saves the wheel hubs, which are not often fitted with liners except after long service. Then both cast iron and bronze are used for hub liners. Bronze is largely used on trailer wheels. Records of over 180,000 miles between shoppings, on passenger locomotives speak well for the wear of the babbitt facings on the driving boxes. This mileage is, of course, above the average, from 40,000 to 60,000 being perhaps more common in freight service. But it must be remembered that this is largely a mountain road with numerous curves of short radius.

The flue welding practice differs from that of most roads. New flues are not welded in the sheet when the locomotive first goes into service. After the engine has run a little while and the oil and grease is thoroughly burned out, the flues are reset with the expanding tool, the heads turned over on the sheet once more, the sheet sand blasted and the flue welded to the sheet by the electric arc, using a small amount of metal in the process.

Neither arc or flame welding is used as extensively

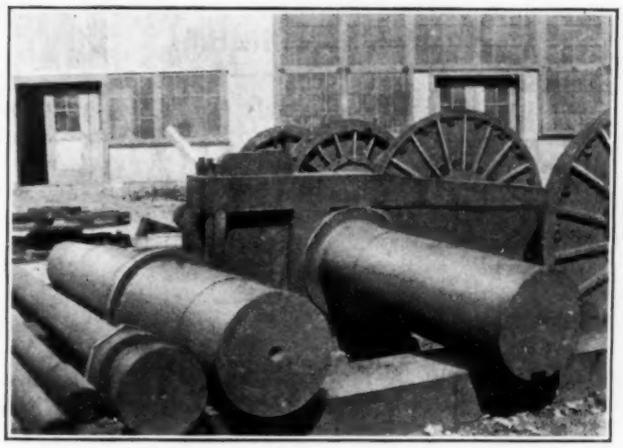


FIG. 2—SPARE PARTS FOR MARINE ENGINES

as in some places. While the arc is commonly used for repairing frames in many shops, it does not find favor here. Instead the welds are made with an oil flame and the welding done with heavy hammers. In many cases a piece is cut out, a new piece made and held in position with a piece of plate steel between the original ends. Then a fire-brick muffle is built around the frame and a large blow torch is turned on each side of the frame and the metal brought to a high welding heat. A heavy air hammer on each side gives a kind

Av. Ex. Rate and Value, U.S. Dollars .170 3,423,281 .173 3,607,429 .178 2,058,036 .135 3,345,472 .070 5,882,054
* Detailed returns are not available. † Seven months' average. Q.M. = Metric quintal = 100 kilograms = 220.46 lb

of blacksmith's forge weld which has proved very satisfactory. One of the oil heating outfits is shown in Fig. 1. It is portable and easily operated.

Some of the experiences with flame cutting have been unusual and unsatisfactory. In the case of one large forging where a piece was cut out by flame in order to save both forging and machining, cracks developed in service which made it necessary to replace the forging.

In addition to its locomotive work, and it builds loco-

FIG. 3—DETAILS OF CRANK REINFORCEMENTS

motives occasionally as well as repairs them, the Sacramento shop takes care of a lot of marine work for ferry boats and smaller craft, involving considerable crankshaft work. In Fig. 2 is shown a spare shaft that was taken from a boat on account of a crack in one web. This web has been re-enforced by a heavy band which is shown more in detail in Fig. 3. The band is held together by a double lipped key and then tightened by the wedge key behind it.

Chemical Requirements in Cast-Iron Specification

Among the topical discussions at the 26th annual meeting of the American Society for Testing Materials held at Atlantic City, June 26 to 29, 1923, was one on the desirability of including chemical requirements in specifications for cast iron. The committee invited two members to open the discussion, Robert Job presenting the introductory argument for the affirmative, and Richard Moldenke, the argument for the negative. Mr. Job contended that in the case of steam-cylinder castings for locomotives, few consumers would have the hardihood to pin their faith merely to the physical tests, and that as a result of practical experience, it has been found desirable to hold the chemical composition within certain limits. As another example, he cited such castings as evaporating pans or grate bars, where an iron with a high melting point and heat resisting qualities is necessary. While physical tests, including the fusing point, could be made to give this information, he contended that the chemical analysis is simpler and more definite, as well as making it easier for the practical foundryman to meet the required properties.

Mr. Moldenke on the other hand contended that the chemical composition when specified in purchasing iron castings, serves no useful purpose, although there may be occasions when one or more injurious elements always present in cast iron, can be limited to a given maxima.

The first reason why the introduction of chemical requirements into the usual specifications for cast iron is undesirable, is that, wherever it has been tried in a general way, it has failed of its purpose. One prominent engineering society, which went into the subject very thoroughly, found that to include all the compositions of castings coming under each separate line of work for which actual specifications were to be prepared, would mean that the limit for the several elements in cast iron would have to be held so wide that no useful purpose would be served. The project was therefore abandoned.

Present Day Compositions Differ from Old

The second reason why chemical compositions at given figures should not be required of foundrymen in specifications they are to work under, is that the history of the development in foundry practice has shown that present-day compositions are considerably different from those considered necessary some years ago. Silicon is a good example of this. With more knowledge of the bad effects of dissolved iron-oxide in cast iron and definite information on the progression of cupola melting, the same grades of castings are now produced with much lower silicons than formerly.

Much of the trouble formerly attributed to sulphur is now known to have been caused by oxidation phenomena. Even phosphorus has come in for greater attention than formerly, though in the direction of limiting it more closely. For, with the better iron that can now be made, the phenomena of segregation had become more acute, as the metal remains fluid for a longer time.

Mr. Moldenke concluded that it is unwise to add to the troubles of the foundryman by imposing chemical requirements on him in addition to the physical ones. Either one or the other should be imposed, but not both. If the consumer wants a given composition the foundryman can furnish it, but then the consumer is responsible for the physical characteristics of the work. But if the consumer wants the castings for his service requirements, the foundryman should be unhindered in working out the problem as long as the service requirements are met.

Tractors in Logging Industry

Tractors are being used in increasing numbers in the mahogany industry in British Honduras, according to a report to the Department of Commerce from Consul Early, Belize. For over 200 years there has been a more or less successful exploitation of the mahogany and cedar forests by means of primitive although expensive methods, but with the depletion of easily accessible timber more modern methods of logging are required for profitable exploitation.

The result has been an increase in the use of tractors for hauling logs. The largest mahogany contractor in British Honduras has invested nearly $100,000 in tractors manufactured in the United States during the present mahogany season. With the use of about 70 tractors this operator expects to get out about 5,000,000 ft. board measure. Several other companies are also using tractors. It is estimated that about 75 tractors have been imported in the past twelve months for hauling logs. This report shows an example of the export opportunities for machinery.

A New Tool For Standardizers

By F. J. SCHLINK
Assistant Secretary, American Engineering Standards Committee

Preferred number series and their place in standardization —Systems adopted by German and French standards bodies —Inception of the idea in America and progress made

PRACTICALLY every article we use is associated in some way with a designation of size, whether specifically, as a two-inch pipe or a six-inch screw driver, or in the form of a rating as to capacity or performance, as a forty-watt lamp. In other cases the naming of the size is only by implication, as in the case of sewing needles or thread, where we refer to them as No. 4 or No. 60, for instance, in which the numbers have only an indirect and often ill-defined relation to any actual or controlling dimension of the article. In a few cases, objects are sized by the vague terms, "small," "medium" and "large." Such diverse objects as frying-pans, tent canvas, thimbles, desk tops, and fence wire are all subject to some sort of a size numbering system in commercial transactions and in technical use; yet there has never been a universal or agreed basis of such sizes, either as to units used (inches or feet, pounds, grains or ounces); the kind of dimension, whether length, weight, diameter, height, cost or some other characteristic, that is to be used as the basis of graduation or fundamental dimension of the successive sizes in the size series; or, third, the principle of law by which the dimension chosen should progress or increase in this series.

THE INVESTIGATION of the problem of preferred number series and their application to standardization was taken up by the American Engineering Standards Committee largely at the instance of Major Glen F. Jenks, Chief of the Artillery Division, Ordnance Department. Major Jenks has been a close student of preferred numbers and had this to say about them in a recent letter:

We know that too great variety has been demanded and unnecessary sizes asked for and carried in stock. If sizes are to be eliminated we must study the theory underlying sizes. This study brings us up to the discovery that the number of sizes fixed by the demand of the consumer really increases by certain definite laws.

The next question naturally is, can a definite law be found that underlies sizes of all products. If such a law can be found it will be of great assistance to all who develop new sizes, and to those who study standardization and simplification of sizes through elimination. The expression of such a law leads us to preferred numbers.

Within the past few months, the American Engineering Standards Committee has given careful study to certain proposals originating in Europe, for standardizing the methods by which such series of sizes are built up, and has brought this new idea to the attention of a large number of American engineering and industrial organizations.

The fundamental elements of the system called Preferred Numbers lie first in the proposal to arrange standard size series so that each succeeding model in the series shall be larger than the preceding size, not by a definite amount, but by a fixed percentage. Thus if fountain pens are to be graded by ink capacity (as they already are in a sense) each successive size of pen in a maker's line, instead of holding an additional fortieth of an ounce of ink, would hold say half again as much ink as the preceding size. This would obviously be a much better arrangement as one who wants a larger fountain pen is sure to think of the ink capacity of the new one in terms of the one he is using, rather than with reference to any fixed increment such as one-fortieth of an ounce. Very few people indeed would have any concrete idea as to the real writing significance of that amount of ink, but it means something to say that the new pen holds fifty per cent or one hundred per cent more ink than some other and familiar size of pen.

Similarly with sheets of letter paper, it is of little immediate practical use to refer to a new sheet as having an additional forty square inches of area, but to say it has fifty per cent more writing area carries very real and immediate significance.

Examining some of our more common size series in this simple way, Messrs. C. F. Hirshfeld and C. H. Berry in their paper on the subject before the A. S. M. E., the first public discussion of the question that has been given in the United States disclosed some very striking results. For instance in the case of wire nails, it was found that when the strength under the blows of the hammer was considered, successive standard sizes of nails show a quite irregular variation. The five-penny nail is only half as strong under the hammer as a four-penny nail, and the nine-penny nail is just about as strong as the four-penny nail; yet any purchaser would assume that as the nails got heavier and more costly the driving strength would increase progressively and not irregularly. It is apparent, therefore, that in any size system it is essential that the proper dimension or property be selected as the

basis of gradation. In this case the nails instead of being sized indirectly on the basis of weight, should probably be sized by driving strength, which is a function of length and wire diameter together. Customary size series thus may be faulty, not only in the spacing of sizes in the series, but in the choice of the property or dimension which determines the size designation.

This is a fair example of the way size series have grown up. Nail sizes actually originated in the cost in English pence of 100 nails, back in days when nails were made by hand smithing, and certainly at a price having no relation to the prices now current. The new size series idea seeks to base the size of such articles on some property or dimension bearing definitely on serviceability, rather than on some accident or practice, more or less shrouded in tradition, and long since invalid as a controlling factor.

1 to 10 mm.				10 to 100 mm.				100 to 1000 mm.			
5 Series	10 Series	20 Series	40 Series	5 Series	10 Series	20 Series	40 Series	5 Series	10 Series	20 Series	40 Series
1	1	1		10	10	10	10	100	100	100	100
							10,5				105
		1,1				11	11			112	112
							12				118
	1,2	1,2			12,5	12,5	12,5		125	125	125
							13				132
		1,4				14	14			140	140
							15				150
1,6	1,6	1,6		16	16	16	16	160	160	160	160
							17				170
		1,8				18	18			180	180
							19				190
	2	2			20	20	20		200	200	200
							21				210
		2,2				22	22			225	225
							24				235
2,5	2,5	2,5		25	25	25	25	250	250	250	250
							26				265
		2,8				28	28			280	280
							30				300
	3	3			32	32	32		320	320	320
							34				340
		3,5				36	36			360	360
							38				380
4	4	4		40	40	40	40	400	400	400	400
							42				425
		4,5				45	45			450	450
							48				475
	5	5			50	50	50		500	500	500
							52				530
		5,5				56	56			560	560
							60				600
6	6	6		64	64	64	64	640	640	640	640
							68				680
		7				72	72			720	720
							75				760
	8	8			80	80	80		800	800	800
							85				850
		9				90	90			900	900
							95				950
10	10	10		100	100	100	100	1000	1000	1000	1000

FIG. 1—TABULATION OF PREFERRED NUMBERS AS DEVELOPED FOR THE METRIC SYSTEM AND APPROVED BY THE GERMAN STANDARDS COMMITTEE. THE FRENCH HAVE ADOPTED A SIMILAR SERIES

This same important defect of existing series of sizes is of course characteristic of many other lines of commodities.

One man, chief engineer of a large machinery concern said of the product of his industry that "not only cylinder sizes, but the sizes of shafting, gears, drums, etc., follow no specified rule, but just simply happen. . . . Who actually determined these things, no one may know today, nor by what means they determined them, and yet the tenacity with which we stick to these things almost amounts to a form of ancestral worship." Continuing, he said that when sizes of parts of his product were re-selected on a preferred number basis, the machines "showed a fine, progressing uniformity, and strange as it may seem, the resulting load capacities were more suited to the requirements of this type of machinery than the existing series of designs . . . giving due consideration to all the factors that determine such capacities."

The War Department has requested the services of the American Engineering Standards Committee in working out on a national scale, a single system of preferred numbers as a basis of simplification of design practice, as it considers that the design of military ordnance is a problem in which some form of preferred numbers is coming to be essential, in order to reduce the large variety of parts and the quantities of special facilities now involved in the production of war material. In making this request the War Department says:

It will be appreciated that Ordnance covers an extremely wide field of design and a great multiplicity of sizes. Of course most of this material is of special design and is not made for commercial purposes. However, in time of war all of it must be manufactured in industrial plants.

It is, therefore, of the greatest importance that the design of Ordnance be simplified as far as practicable, and that it be standardized with industrial products. . . .

Of course considerable simplification . . . is possible through the adoption of commercial standards. There remains, however, a wide field in which commercial standards do not apply. For example, in the diameter of cylinders whose dimensions are greater say than 2 in., at present the designer is satisfied if he rounds off his dimensions to an even fraction of an inch. The result is of course, much multiplicity of sizes which may appear reasonably standard but which differ from each other by such insignificant amounts that they really represent special rather than standard sizes. . . .

It would be a great step in the simplification of design if a system of preferred numbers were used. . . .

If the design practice of Ordnance has been simplified in the same manner as the design practice of industrial products, naturally the war production problem would be correspondingly simplified.

It seems to the Department that some progressive manufacturers are going to apply systems of preferred numbers in the design of their products. If there is this demand on the part of the industry for such simplification of their product it would be highly advantageous to the Department if the different industries interested would combine in using the same fundamental system. . . .

It is therefore hoped that your Committee will permit the use of the mechanism of your organization for industrial manufacturers as well as Government organizations to attempt to work out a single system of preferred numbers as a basis of simplification of design practice.

Such a system should show large economies in the important and costly work of developing and revising designs of military ordnance—guns, gun-carriages, caissons, trucks, etc., in which the multiplicity of unstandardized parts and sizes of hinges, pins, bolts, wrenches, hand-wheels and the like, makes the ordinary uncorrelated methods of mechanical design slow and costly and calls urgently for a universal, broad and consistent scheme of sizes.

The economic loss involved in the haphazard and often unnecessarily numerous gradations of size that characterize many of our common commodities must in the aggregate amount to a huge sum, and a real survey of the more important commercial series of sizes would be very interesting and would probably pay large dividends in direct and indirect commercial savings.

Another essential of the new proposal, is that the numbers representing successive sizes shall not only lie in a series giving a uniform percentage increase,

but also that the actual size numbers used shall reappear in all series, so as to build up, as it were, a standard set of numbers which would be used constantly and almost universally in commercial transactions and in engineering design calculations. Such a series for instance is given by the numbers 10, 16, 25, 40, 64, 100 which by a simple shift of the decimal point gives us a new series 1.0, 1.6, 2.5, 4.0, 6.4, 10.0, or again 100, 160, 250, 400, 640, 1,000.

The first series might be used for grading the numbers of bolts or buttons in a package or carton, the number of lines in an apartment house telephone exchange, or the diameters of the telephone wires in thou-sandths of an inch. Obviously the shift of the decimal point enables the same basic numbers to be used for all sizes, from the very smallest to the largest for which there is any possible use. A freight car capacity of 64,000 pounds, or fence wire 64 thousandths of an inch in diameter would be preferred number sizes. Of course the series need not start with the first number given in the foregoing list. It can start with any number of the series which seems best suited to determine the smallest needed stock size, and can continue through any number of "decades" to the largest needed stock size.

These number series have been elaborated to provide another interesting and important property. If the five numbers just listed are not enough to give a satisfactory and economical series for a given line of material, let us say valves for water pipes, we can insert a new

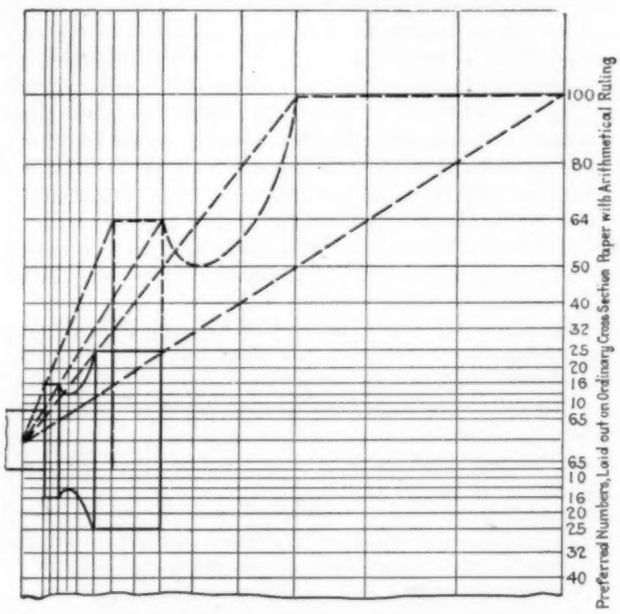


FIG. 2—A CONVENIENT METHOD OF REPRODUCING THE PROPORTIONS OF A GIVEN KNOB ON A LARGER OR SMALLER SCALE, THE NEW DIMENSIONS BEING PREFERRED NUMBERS ALSO. (AFTER C. von DOBBELER)

preferred number between each two of these already in the series, and we have a new series with twice as many terms, and with this important advantage, that sizes of the first series are all found in the second one, so that if in keeping up with developments in the trade it becomes necessary to increase the number of valves in a line, all of the old sizes stand, and we simply insert new sizes one at a time, or if desirable, two at a time, in such parts of the series as seem to demand extension. Thus the new series, comprising twice as many steps as the first, is as follows:

10, 12.5, 16, 20, 25, 32, 40, 50, 64, 80, 100

In the first series the successive terms are each 60 per cent larger than the preceding term, while in the second case the rate of growth is 25 per cent. By an extension of the same process new series can be built up, in the occasional cases where they are needed, hav-

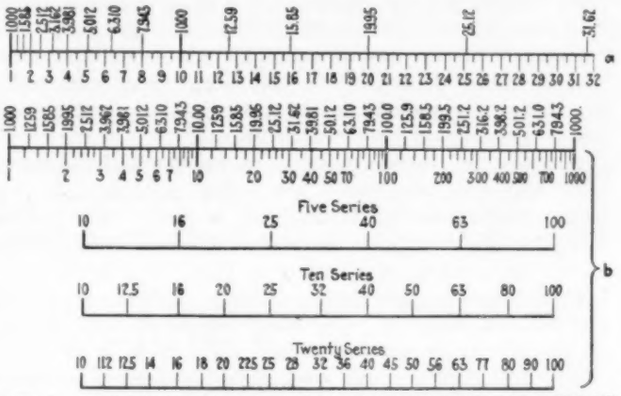


FIG. 3—SHOWING THE SPACING OF PREFERRED NUMBERS ($\sqrt[n]{10}$ BASIS) ON THE ORDINARY 1, 2, 3, 4, 5 ..... SCALE OF NOTATION (A) AND ON A LOGARITHMIC OR GEOMETRIC SCALE (B). NOTE THAT THE PREFERRED NUMBERS ARE UNIFORMLY SPACED ON THE LATTER SCALE AND THAT SUCCESSIVE SERIES (5, 10 AND 20 NUMBERS PER "DECADE") ARE PRODUCED BY SUCCESSIVE HALVING ON THE LOGARITHMIC SCALE. (AFTER RUEDENBERG)

ing 20, 40 or 80 terms, between 1 and 10, or between 10 and 100, corresponding to rates of increase of 12, 5, and 3 per cent respectively, and each of these series contains all of the terms of the preceding ones, a feature which has obvious and important advantages. Of course for the great majority of uses the 5-term and 10-term series will serve our purposes, and in these series the person who works with commercial products will rapidly learn all the numbers involved, so there will be little need for that constant reference to tables of dimensions which is now so necessary to the designer, engineer, draftsman, foreman, workman, the amateur scientist and the householder, whether the work concerns wire nails, screws, washers, sheet metal, pipe, drills, motors, paint brushes or any other line of materials which must be dealt with in a series of sizes.

It may be that on account of the simplicity of the preferred numbers and their arithmetical convenience, their use would extend in such a way as to displace our numerous mutually inconsistent and confusing so-called "gage" sizes, that is, the arbitrary numbers and names that are used in referring to such diverse commodities as corks, tubing, envelopes, nails, flags, artist's brushes, etc. Furthermore, the ease in designating a size which such a system affords may have an important reaction in the direction of standardization, by favoring the use of uniform size for uniform purposes. How important this point is may be judged from facts recently brought out by the Committee on Simplification of Paper Sizes appointed by the Bureau of Standards. For example, of 177 books printed by one concern 101 were actually of different sizes. Similarly, in 57 prominent magazines of national circulation, 27 different pages sizes are used. If preferred numbers can make the designation of such sizes simple, and avoid the use of arbitrary terms in so doing, it is quite likely that the idea of standardi-

zation, with the enormous economies in manufacture and in distribution which follow may spread through many industries which it has as yet hardly touched. One maker of bolts was using 28 sizes of pasteboard cartons for packing his product. On changing to a new series of sizes, laid out on a percentage-increase basis, only half as many sizes were needed, and the uniformity of packing was more satisfactory than before. Similarly the number of wooden packing boxes was reduced from 50 to 23 by the same process. The resistance to the use of standard materials and sizes will be much decreased by any step which can unify the basis of standardization and give it a common and easily understood basis of reference.

Already, in Europe, notably in France and Germany, duly approved standards are being published by national standardizing bodies, on a preferred number basis, on such subjects as tools and toolholders, strips, sheets and tubes of aluminum, paper for books, etc., carbon brushes for street railway motors, etc. The simplifying effect of such standardization with regard to the last item can be judged when it is known that there are now in use over 6,000 different sizes of brushes for electrical motors. Putting the sizes of these on a uniform basis would, by favoring mass-production, reduce the costs of *all* such brushes.

A Very Important Development

There is no doubt that this is the most fundamental and far-reaching development which has as yet come before the American Engineering Standards Committee for investigation. The committee is studying the question of how the necessary extensive investigation of the subject on the part of the numerous branches of industry may best be brought about, in order to determine the relative advantages and disadvantages that would be involved in its adoption; to see whether such a scheme can be applied in a national way to the problems of American industry and trade; and to determine, moreover, just what detailed technical basis for the system, if one is adopted, will best serve the practical and theoretical requirements of the problem. A special committee appointed by A. W. Whitney, chairman of the A.E.S.C. and headed by Maj. Glen F. Jenks, Chief of the Artillery Division, Ordnance Department, U. S. A., recommended that the work on the subject including a study of the principles underlying the application of preferred numbers to size standardization, and the development of a recommended system of preferred numbers, should be carried out by a special committee of the A.E.S.C. as representing the National Engineering Societies, industrial organizations, and interested Government bureaus.

An important point that must be kept in mind in any practical consideration of such a proposal, is that its immediate application can only be in guiding new standardization work and in reformulation of old standards when for any reason such revision is undertaken. Many existing trade practices are as has been pointed out on such a dubious basis in respect to the fundamental ideas and practices involved, that a re-examination of such standards to put them on a definite and uniform basis can probably best be carried out with some such guide as the preferred number plan. This is probably the case with many of the items already mentioned, and with other items which are either unstandardized or of which the standards are uncertain or have been developed in a loose or unscientific manner. The correction of such conditions can only be done slowly and carefully and as opportunities for revision arise in the ordinary working out of improvements by trade and technical associations and other organizations that develop standards and specifications.

It is an interesting fact that some of our products that are most highly developed from the scientific and engineering point of view already fit the preferred number series quite closely. This has been found to be true of capacities of druggists' bottles, the diameters of electric wire, the wattage of incandescent electric lamps, the horsepower of certain types of electric motors and steam engines, the sizes of stay wires for airplanes, and even of the vibration frequency of the tones of the musical scale.

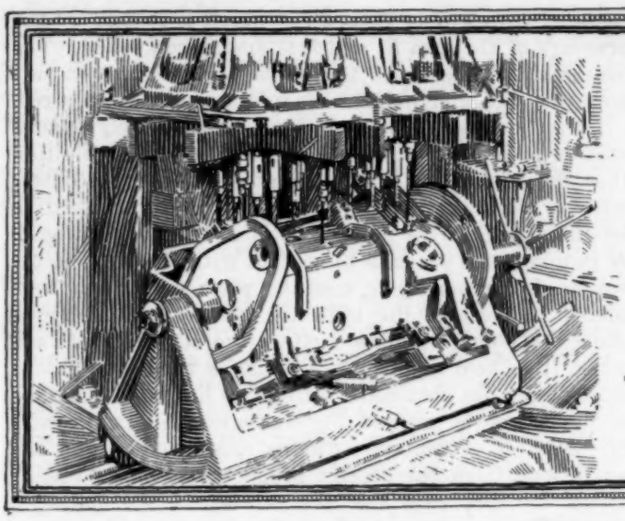
Factors Governing the Strength of Gear Teeth—Discussion

By Douglas T. Hamilton

The criticisms made by G. W. Drake on page 24, Vol. 59, of *American Machinist*, of my method of determining the tooth proportions of a helical gear on the normal plane, are perfectly logical if we consider that the gear has been produced by a regular spur gear cutter. But the writer was not dealing particularly with methods of cutting, rather with the factors that affected the strength of a helical gear tooth. It will be readily understood that if the gear were produced by a regular spur milling cutter, the thickness on the normal plane would be the same as on the diametral plane of a regular spur gear, and the thickness on the diametral plane would be greater. The problem was to find the thickness of the tooth, and as the gear shaper method is commonly used for cutting gears on a production basis, and one with which the writer is well familiar, this method was selected as an example to show the methods used in determining the normal tooth elements of a helical gear, the diametral tooth elements of which are the same as a regular spur gear of the same pitch.

The diametral plane method of figuring helical gears has several advantages. For instance, take the question alone of changing over from spur to helical gearing. By the normal pitch system, as Mr. Drake suggests, a compromise is always necessary, and if the same center distance and tooth ratio must be maintained, it is quite a problem for a man who is not experienced in gearing to work it out satisfactorily. The other method, figuring the tooth parts on the diametral plane, is a comparatively simple proposition.

Mr. Drake makes a rather broad statement when he says that it is the almost universal custom to cut helical gears with regular standard spur gear cutters. The writer does not want to get into a discussion here regarding the comparative merits of different methods of gear cutting; he simply wants to point out that there are two methods of calculating the tooth proportions of helical gears. The method outlined in his article is by far the simpler. Because it is common to one method of gear cutting only is nothing against it. The same tooth proportions can be obtained by other forms of gear cutting tools, provided they are made so as to cut standard diametral pitch helical gears, instead of cutting mongrel gears, which are not only difficult to measure and apply, but involve some rather technical calculations.



Tool Engineering

By

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Inspection gages—Important points of design—Value of indicating gages—Testing irregular contours—Gaging relation of holes to surfaces

GAGES used for determining the accuracy of work after it has been machined are usually referred to as inspection gages. This variety covers a wide field and, as previously mentioned, the line of demarcation between work and inspection gages is not very clearly defined, as the same types of gages are often used for both work and inspection. However, for our purposes it is only necessary to describe the types of inspection gages which are radically different from work gages.

In considering the matter as applied to the design of gages of this type, there are a number of points of importance to which attention must be paid.

(1) Inspection gages may be used either between operations or after all the operations are completed on a given piece of work. In the former case it may be necessary to test the accuracy of one or two surfaces only, while in the latter instance the requirements make it necessary to gage all the important dimensions on the work. It is often possible and even desirable in many cases to make a testing fixture for the final inspection. This fixture should be so designed that the work can be located in it in a fixed position and all surfaces tested at the same time. Progressive gages, which are so made that the work is passed through a number of gage points located on a plate or in some other convenient manner, are sometimes used for final inspection. When screw machine work of certain kinds is to be inspected and there are a number of different diameters on the work, this method has found favor with some manufacturers.

(2) In the final inspection it may be an advantage to allow slightly greater tolerances than those used for the work gages. This matter should be settled by the engineering department in conference with the factory management when planning a gaging system. The advantage of greater tolerances for final inspection lies in the possibility of saving work which would otherwise be "scrapped" or sent back to the machine shop for additional work. A decision on this matter should not be given without careful consideration. In many factories the tolerances are the same for both work and inspection gages.

(3) The number of pieces to be gaged always affects the design of gages to a considerable extent, particularly when considering those used for final inspection. When work must be kept within very close limits, the gages must be carefully designed and provided with means for adjustment to counteract the effects of wear.

(4) Periodical inspection of gages is of the greatest importance, and too much stress cannot be laid upon this feature. Any system of gaging which does not take this matter into consideration is greatly lacking in efficiency.

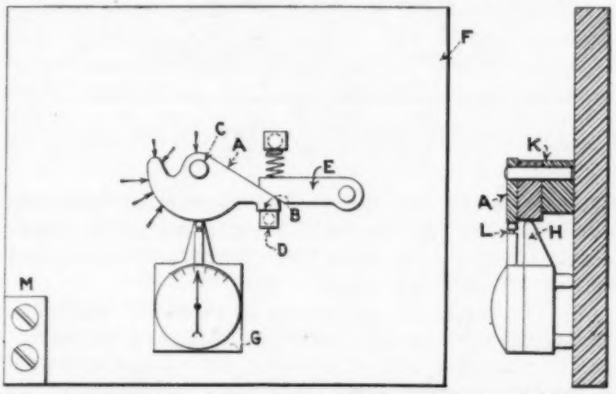

FIG. 545—METHOD OF GAGING AN IRREGULAR CONTOUR

The best results are obtained only by frequent inspection and the resetting of all gages used, to their correct sizes. Probably the best way of doing this is by the use of duplicate gages, one set being checked and adjusted while the other set is in use. In large factories a department can be established for this purpose, and the results obtained will fully repay the trouble taken.

(5) The type of gage best suited to the testing of various parts must be determined by several factors. The accuracy required in the work is an important one of these factors. The quantity to be inspected also affects the design strongly. When only a few parts are to be inspected the simpler forms of gages will prove satisfactory, but for high production refinements of various kinds are needed. Furthermore, the element of time taken for the inspection process is important and, therefore, the gages should be so designed that they can be rapidly used and easily read. Generally speaking, inspection gages should be so designed that they indicate the amount over or under size, as well as the required tolerances.

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(6) Standard measuring instruments for the final inspection can frequently be used to advantage, either as applied to a fixture or by themselves as separate units. There are a number of instruments on the market which are suitable for obtaining very accurate readings on different kinds of work. The designer should become familiar with these types, in order that he may not go to the expense of making up something special when a standard instrument will answer the purpose. We have previously mentioned dial indicators and other indicator types, and it is obvious that micrometer heads and verniers of different kinds can also be used. Johansson gage blocks can be readily adapted both for setting instruments to accurate sizes and also for making up standard dimensions within a very close limit of accuracy. The "Prestometer" or fluid gage can be applied to a number of inspection problems with excellent results. There are also very accurate measuring instruments which can be used for test purposes when required. We do not feel that it is necessary to mention

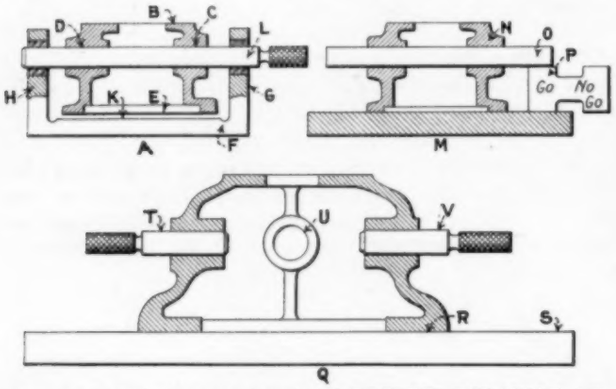

FIG. 546—PRINCIPLES USED IN TESTING RELATION OF HOLES TO SURFACES

these devices specifically, but we recommend that tool engineers who are interested in the design of gages become familiar with these instruments and understand thoroughly their application.

(7) The use of an instrument by means of which the shadow of a given piece of work can be projected at greatly magnified size on a screen for comparison with an accurate templet, has proved very successful in the inspection of threaded work, gear tooth shapes and similar forms. We shall take up this instrument later in the series in order to show the principles on which it is based.

In many kinds of work the entire contour or profile of a piece of work is important, and if this profile is irregular it is somewhat difficult to gage it by any of the methods which have previously been mentioned. The old method of testing work of irregular shape was by means of a receiver gage. The work would be placed in a gage of this sort and an inspection of the contact at various points would determine whether or not the accuracy was sufficiently close to fulfill the requirements.

In order to simplify the gaging of contours a dial indicator may often be used with gratifying results. Fig. 545 shows a piece of work *A* which has an irregular contour, some portions of which must be held accurately to size. The work has been machined all over, and the surface *B* determined in relation to the hole *C*. It is necessary to determine the correctness of the form at the points indicated by the arrows. This form must bear a certain relation to the hole *C*, and the portion *B* contacts with a plug *D*, against which it is held by the pressure of the arm *E*, which is spring controlled. The base plate *F* is scraped to a plane surface, and on this plate the indicator holder *G* is moved about as required.

Directly underneath the work *A* an accurately formed master plate *K* is positively located in such a position that the indicator holder *G* can be brought in contact with it through the point *H*. The indicator itself is mounted so that the contact point *L* is above the point *H* in a suitable position to contact with the edge of the work. In preparing to test the piece which has been placed in position the indicator holder is moved over until the pointer strikes against the set block *M*, and while it is held against it the dial is turned so that a zero reading is obtained. After this has been done, the holder is moved around the contour of the work with the point *H* in contact with the master plate, and any variations from the correct proportions can be readily noted by observing the fluctuations of the indicator pointer. This method of testing irregular forms has been found very successful, and it can be applied to many cases of a similar kind.

Gaging Relation of Holes to Surfaces

It is frequently necessary to test the relation of a hole to an adjacent surface. This surface may be parallel or at right angles to the hole, or it may be at a specified angle. When the hole and surface are at right angles there is no particular difficulty in testing their relation and the operation can be done by making use of some of the principles which have previously been described. When the surface is at an angle to or parallel with the hole more care is necessary, and as it is cases of this sort which are often troublesome to the gage designer, we shall illustrate graphically some of the difficulties encountered.

There are many gages made for the purpose of testing finished work which are incorrect in principle; and yet, they are often used in the factories with partial success due to careful handling on the part of the inspector. It is our belief, however, that a gage or testing fixture should be so made that it requires a minimum amount of judgment on the part of the inspector. In other words, the gage should show conclusively that a piece of work has been machined within the required limits or not. There are, of course, exceptions to this rule when parts are manufactured in small quantities, and when it would not pay to make up expensive testing fixtures on account of the limited production.

In Fig. 546 is shown at *A* a piece of work *B* which has been completely machined, and in which the cross holes *C* and *D* must be parallel with the lower surface of the casting *E*. The designer, being somewhat inexperienced, made up a testing fixture consisting of a base *F* at each end of which there is a lug as shown at *G* and *H*. In these lugs hardened bushings are placed, as indicated, at a fixed distance from the surface *K*. The intention is to place the work in the fixture so that surface *E* rests on surface *K*, and then pass through the two holes *C* and *D* the long cylindrical plug gage *L*, which will show whether or not the surface *E* is correctly located with respect to the two holes.

Let us examine this testing fixture and see what would happen in the event that the location of the hole should be a shorter distance from the surface *E* than required. In this case the plug would enter and pass through the holes without difficulty, but it would at the same time lift the work away from the surface *K*

an amount equal to the variation in the given dimensions. On the other hand, if the holes *C* and *D* were bored too far away from the surface *E*, it would not be possible to enter the plug at all. There would be no way of telling how much over or under size the work might be when using a gage of this sort, and yet the writers have seen a number of gages built on this principle in use in different factories. As a matter of fact, it can be readily seen that the principle here used is absolutely incorrect, and its use should never be tolerated.

The arguments which may be used are that the number of pieces required would not warrant any great expenditure for a testing fixture; and yet the problem in itself is a very simple one which can be readily solved by application of the principles shown at *M*. Here the work *M* is set up on a surface plate and a plug *O* is passed through both holes as shown. A simple type of limit gage as shown at *P* can be passed under each end of the plug, thus clearly showing whether the relation of the hole to the lower surface is within the tolerances specified or not. One could hardly imagine a much simpler method of gaging than this. The same principle can be used and a slightly more elaborate fixture made if desired, indicators being used in place of the limit gage in accordance with the designer's preference.

In another example, shown at *Q*, the work is of similar form but there are four holes, the relation of which must be gaged with respect to the lower surface *R*. When only a few pieces are required the work can be set up on a surface plate *S*. Then, by using plug gages at *T*, *U* and *V*, an indicator of the dial type suitably mounted can be passed over these plugs after it has previously been set to size by means of Johansson blocks or an end measuring gage. The fluctuations of the indicator will immediately show any variations over or under the specified sizes.

The same result can be obtained by mounting separate indicators in such locations on a fixture that the plugs will come in contact with them when entered in the holes. There are a number of applications of indicator gages which can be made to suit conditions of this sort, and a little ingenuity on the part of the designer will enable him to work out a design suited to the condition.

Use of Double-Acting Machines—Discussion

By Albert Clegg
Yorkshire, England

IN AN article under the above title on page 560, Vol. 57 of the *American Machinist*, Robert Grimshaw discusses the utility of various double-acting machines and proceeds to advocate the application of this principle to metal planing machines, by eliminating the idle return stroke and introducing in its place an extra cutting stroke. Mr. Grimshaw refers to a "jack-in-the-box" tool-holder occasionally come across in England and suggests that something of the sort should be worth more general adoption.

Now in view of the obvious advantages accruing from the cutting out of the non-productive return stroke of planers, it does seem rather surprising that more attention has not been given to the subject and that much greater efforts have not been made to introduce more generally so potent an improvement. We find, however, that very few of the world's planer builders attach any importance to the subject. Their whole efforts seem to be concentrated on the production of higher and still higher return speeds, the possibility of increasing the productive value of the machines by arranging for double-cutting being apparently ignored in the vast majority of cases. It is the return speed of the modern planer which determines the power consumption, and also the size of motor required to drive, and it is the return speed too which subjects the driving mechanism to its greatest loads and heaviest shocks. Surely then it should be worth while giving more attention to the possibilities of double-cutting, rather than so much time to the means whereby the return speed can be still further increased.

Buckton & Co.'s Machine

One of the firms who has devoted considerable time to the perfecting of a double-cutting tool-box and who has for years advocated the adoption of the principle for all classes of work is Joshua Buckton & Co., Leeds, England. For twenty years this company has been building planers arranged for double-cutting, and incidentally, it has, for a like period been building planers fitted with the now well-known Sellers' drive, in which a spiral pinion meshes into the rack. Whereas the original Sellers' drive had bevel gears to connect the pulley shaft to the spiral-pinion shaft, the Buckton firm uses spiral gears at this point, thus producing a machine which is completely driven by spiral gears, and, as a consequence, capable of running with practically no noise whatever. In spite of the fact that it is twenty years since this company supplied the first spiral geared planer—and it has supplied hundreds in the meantime—it has never yet had to replace a worn-out or broken spiral pinion. It should also be stated that the product is not confined to small planers; on the contrary, the company has a name and reputation for the heaviest classes of machine tools, and the spiral-geared planer is regularly made in sizes up to 10x10x30 ft., which proves that the system is applicable to the heaviest classes of drive.

Efforts to Popularize Cutting on Both Strokes

It was probably due to the efforts of J. Hartley Wicksteed, late managing director of the company, that so much has been done to popularize the idea of cutting on both strokes. Some eleven years ago Mr. Wicksteed read a paper before the British Institution of Mechanical Engineers, in which the design of high-speed, double-cutting planers was dealt with, and it is rather a significant fact that the balance of the arguments in the subsequent discussion were all in favor of the principle of double-cutting. The author's treatment of this phase of the subject was approximately as follows:

One of the arguments often advanced against the planer, shaper, slotter and other similar types of reciprocating tools, is that they are necessarily uneconomical by reason of the idle return stroke, and therefore such tools are not really as efficient as the continuous-cutting tools such as the lathe and milling machine. The reduction of the idle time is a problem which has exercised the minds of machine tool designers for a long time, their efforts usually being in the direction of faster and still faster return speeds. It is undoubtedly true that some remarkably good results have been achieved in the way of high-speed return strokes, but it is not so definitely certain that this method of solving the problem has been the one offering the best chances of success. In most high-speed planers it is the re-

turn speed and the shocks generated thereby which are the limiting factors of the design, since they are so very much greater in intensity than the stresses imposed by the comparatively slow cutting strokes. It is the return speed which is invariably the punishing element so far as the driving mechanism is concerned.

Now there is a limit to the magnitude of the return speed, and this limit is more or less determined by the size of the machine—the larger the machine, the less the return speed, and conversely, the smaller the machine the greater may be the return speed. In any case, no matter how high a return speed may be used, there is certainly no doubt that the return stroke is an idle one since no useful work is being done. Further, after a certain point has been reached, the advantages to be derived from a still further increase of speed are so small as to be practically negligible.

Cutting and Return Speeds

Take a planer operating at a cutting speed of 40 ft. and a return speed of 120 ft. the length of the stroke being 10 ft. The cutting stroke would take 10/40 min. and the return stroke 10/120 min., the complete cut and return cycle being made in 40/120 or 0.333 min. Now suppose the return speed was increased to 200 ft., the time taken for the return would then be 10/200 min., and since the cutting time would remain the same, the time for the cycle would be 0.300 min., or roughly 10 per cent less than the former time. If it were practicable to increase the return speed still further to, say 300 ft., the time for the cycle would then be 0.283 min., or a saving of about 16 per cent over the 120 ft. return speed, but of something under 6 per cent as compared with the 200 ft. return speed. The increased stresses on the machine and the increased amount of power required, not to mention the larger amount of time wasted at each end of the stroke, would all be to set off against the theoretical savings given by the above calculations. If the cutting speed were increased, and the extra output obtained in this way without having recourse to super-return speeds, the increase would only be quite a modest one, a mere 10 ft. a minute addition to the cutting speed combined with the lower return speed mentioned above, giving exactly the same rate of production as with the 40 ft. cutting speed and the 300 ft. return speed. It is quite obvious which method will be easiest on the machine.

Idle Time on Return Stroke

However, we must not lose sight of the fact that the return speed is wasted time. With an abnormally high return speed, the time lost will not be very much, but nevertheless it will be lost under ordinary circumstances and providing there is no alternative. We believe there is a practicable alternative, our contention being that on many classes of work, it is possible to entirely cut out the idle return stroke by the simple expedient of providing a special toolholder carrying two sets of tools so as to cut in both directions.

While it is admitted that double-cutting is no new idea, it is really only since the advent of the variable-speed, reversing-motor drive, that the double-cutting system has had a fair chance. Prior to this there was a serious objection to its adoption, since a machine made with equal forward and return speeds for double-cutting was working under a rather heavy handicap when a job came along which was not adapted to double-cutting. Under these conditions, since the return speed was only equal to the cutting speed, the loss of time was such that it discounted the advantages derived from the double-cutting on work where that system was possible. The variable-speed motor drive overcomes this difficulty, because the drive can be set either to reverse at equal speeds for double-cutting, or to give a higher return speed in one direction when the class of work requires a return to the more orthodox method of working.

Advantages of Double Cutting

In planing cast iron the advantages of double-cutting are two-fold; for, besides having two feeds to the tool for each cycle of the table, the back-to-back tools mutually assist each other by chipping away the scale in front of them in each direction, so that each tool has clean metal to enter at all edges of the casting with which it comes in contact. The tools are thus saved from so much wear that, instead of two tools requiring more fixing—as is sometimes argued—they require, on the whole, less fixing than a single tool, since they will do more work per tool because of the absence of contact with the hard skin of the casting.

Also, the first roughing cut is more uniform if made with two tools, because they get so much less worn between the first cut and the last, partly due to each tool taking alternate cuts and thus reducing the wear to half that of a single tool on any given job. It has been found in actual practice that turbine castings, for example, could be planed in less time by double-cutting than by single cutting, even if the time taken by the idle return stroke were eliminated altogether. The reverse position of the back tool also makes it particularly advantageous for taking broad finishing cuts; it does not require cranking back to prevent chatter marks, because it has no tendency whatever to dig in. For the same reason the back tool can also be used to advantage for cutting grooves with a parting tool. In work of this nature, although the double-cutting tool-holders are not changed, the back tool only is inserted and the back stroke can be driven at the desired cutting speed, with an idle return on what would ordinarily be the forward stroke. There are also many occasions where this feature might save turning the work round end for end by having a tool available for planing up an obstruction in either direction.

The manner of double-cutting is to fix both tools precisely back-to-back; in fact, the second tool is adjusted by simply dropping it into the furrow made by the first tool. The back tool follows in the furrow of the front tool until the end of the stroke is reached when it is traversed by the feed motion; it then cuts a further furrow in which its companion follows free, and thus, in a single cycle of the table, two furrows have been cut of equal width and depth.

No Material Results

The above is the substance of Mr. Wicksteed's arguments in favor of double-cutting; it does seem strange that nothing very material has resulted from his efforts in this direction. A big majority of planers made today being still of the old-type idle return-stroke design. It can of course be argued that the bulk of the planers made today are of the belt driven type, that is, not reversing-motor driven. So that in view of Mr. Wicksteed's statement that it is only in combination with the variable-speed reversing-motor drive that double cutting is really practicable, we can only assume that double cutting is dependent on the more general adoption of this particular form of drive.

A Special Planer

Smith, Barker & Willson, Ltd., Halifax, England, several years ago had a special planer built in which an extra set of standards, cross-rail and tool-boxes were provided, mounted opposite the ordinary set and facing them. The idea was to obtain the advantages of double cutting, insofar as the idle stroke was cut out altogether. The firm had the machine built primarily for planing lathe beds, two rows of which were mounted on the planer table at once. There were several combinations on which the planer could be operated. One row of beds, for example, could be planed on one stroke and the second row on the other stroke, the operation being almost exactly as if two separate machines were in use. On the other hand, if required, both sets of tool-boxes could be used on both sets of castings, but this method was not as convenient as the one mentioned where each row of beds was dealt with by its particular set of tools. The countershaft was arranged so that a high return speed could be used on odd-job work which did not lend itself to the double-cutting principle. So far as the writer knows, the machine was, and still is, highly successful and saves a substantial amount of time on the planing of lathe beds.

Industrial Cost Accounting for Executives

By PAUL M. ATKINS

The sixteenth article—Classification and recording of expense accounts—The controlling expense accounts—Operation of detail expense account card—Use of the expense ledger

IN THE preceding articles the composition and content of the various expense accounts have been discussed, but nothing has been said about how the charges are actually to be made to them. The question before us here, therefore, is to investigate some practical method by which the various costs may be accumulated both in the controlling and detailed expense accounts. If the control of the expense accounts is to be satisfactory, means must be provided for checking possible errors and for tying in these accounts with the other general ledger accounts.

We can classify the charge to be made to the expense accounts into four groups:

(1) Indirect material.
(2) Indirect labor.
(3) Outside services.
(4) Internal charges.

As we have already seen, there are many different accounts to which these items should be charged and to many accounts several sources may furnish the debits. It is necessary, therefore, to provide some systematic way to guide the posting of the various transactions which represent the cost of services rendered.

It will be remembered that in a preceding article it was pointed out in connection with the discussion of maintenance charges that all maintenance and repair work should be carried on only on the strength of an order authorizing it. The statement made in respect to such work should be amplified to include all the tasks involved in carrying on the various functions of the business. In relatively few cases it will be necessary to issue work orders except for repair work, but the system of standing orders described in the article referred to is usually employed. It will be recalled that standard practice instructions should be prepared for all the various routine tasks and included in these instructions or attached to them should be an indication of the account or accounts to which the costs of doing the work according to the instructions should be charged. With these instructions and the enacting orders as a basis it is pretty much a matter of routine to charge the proper expense accounts, for every voucher which carries a cost with it may be arranged to show the account symbol to which it is to be allocated.

Material is the first item on the list and is often one of the most important of the elements of the expense accounts. All indirect material like all direct material, should be withdrawn from the store-room only on the authority of a material issue. The material should always bear the expense account symbol to which it is to be charged in addition to any work order or other number of that sort. It should follow about the same routine as any other issue, going to the balance clerk who will enter it on the balance of stores card and price it, and from him to the materials journal clerk who will make the extension and enter it in the stores journal.

It is important to remember that there are several columns in the stores journal for expenses, one for each of the controlling expense accounts. The indirect material issues should be sorted according to this classification and entered in the appropriate column. At the end of an accounting period the columns should be totaled and debited to the several controlling expense accounts in the general ledger. The issues should be sorted daily according to the detailed expense account symbol and

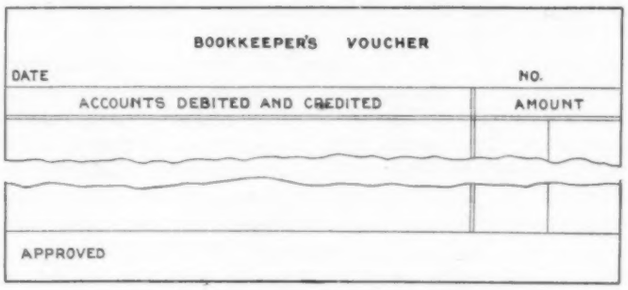

FIG. 45—BOOK-KEEPER'S VOUCHER

placed in a file prepared for the various expense account vouchers.

The allocation of the indirect labor is a little more complex but it does not present any serious difficulties. From the summary of the factory payroll, the entries to the controlling expense accounts may be obtained. Most of the workers on the payroll have time tickets on which are shown the order of account to be charged. For indirect labor this means, of course, the expense account symbol. It is often desirable to make out time tickets for all persons on the payroll whether they are needed for payroll or distribution purposes or not. For such individuals as the foremen and subforemen, inspectors, instructors and move-men, it would be perfectly possible to operate with only an in-and-out clock card record and without time tickets since all their time is charged to one account. It is a very simple matter, however, at the end of each pay period to make out a time ticket for the entire period for each of these workers, showing thereon the earnings and the expense account to be debited. This simplifies the allocation of the charges to the various expense accounts because sorting the time tickets will then accomplish the distribution.

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It must not be forgotten, however, that there is usually another payroll also, the office payroll, and sometimes a third—the private payroll for officers and the higher employees, such as department managers. The method for handling the two payrolls is substantially the same, except for the fact that the private payroll is kept by the chief accountant or some other confidential employee, while the regular office payroll is ordinarily kept by the payroll section of the cost department. Often, such payrolls are paid by check, and frequently, only once or twice a month so that, in general, they are much simpler and easier to operate than the factory payroll. A summary should be prepared in both cases, and from this summary the postings may be made directly to the controlling expense accounts. Instead

DETAIL EXPENSE ACCOUNT CARD

SYMBOL

MONTH

ITEM	AMOUNT
Stores	
Worked Material	
Payroll, Factory	
Payroll, Office	
Voucher Register	
General Journal	
TOTAL	

FIG. 46—DETAIL EXPENSE ACCOUNT CARD

of making out time tickets for each worker, as was proposed for the factory, it is usually much simpler to make use of another form often called a bookkeeper's voucher. The same form is employed in other ways also and will be referred to later. Its form is illustrated in Fig. 45. It is simply a convenient means of transferring values from one account to another within the accounting and cost department. In this case the total charge to each detailed expense account should be summed up on book-keeper's vouchers which can then be sorted into the expense account file referred to previously. In this way the indirect labor charges of all kinds can be allocated to the proper accounts.

The next consideration is the question of the outside charges, so called, such items as telephone and telegraph and electric light and power. They should be recorded in the voucher register and entered in the column for the controlling expense account to which they are to be charged. Ordinarily, there will be columns only for the controlling expense accounts, but if there are certain items which appear often enough to warrant it, special columns may be arranged. For all entries in the controlling account columns, the detailed expense account symbol should be entered also so that the items may be quickly analyzed and summarized at the end of the period.

When the time comes, the totals of the controlling account columns should be posted to the indicated controlling expense accounts. If certain detailed expense accounts have columns to themselves, care must be exercised to make sure that the totals of the columns are also posted to the controlling expense accounts for the group to which they belong. The detailed expense accounts should then be summarized at the foot of each column, and book-keeper's vouchers should be made out for the charge to each detailed expense account. The book-keeper's vouchers should then be sorted according to expense account symbol and filed like the others in the expense account file.

There remains now for our consideration only the fourth group of items which were classed as internal charges. The most conspicuous elements of the group are the fixed charges whose handling has been discussed somewhat fully in a preceding article. The entry in the controlling expense account is prepared in the general journal, it will be remembered, and the posting to the individual expense accounts should be made from the schedule sheets which serve as a sort of perpetual voucher.

There are, in addition, other items from time to time such as the charges for liability insurance, advertising and prepaid expenses of various costs which are charged first to suspense accounts and are then written off by being debited to expense accounts over several accounting periods.

All of these items should be entered in the general journal and from there posted to the controlling expense accounts. Book-keeper's vouchers should be made out for each sum allocated to a separate individual expense account and they should then be filed like the others in the expense account file.

Before going on to a discussion of the detailed expense account file and the methods for dealing with the records which come therefrom, it will be helpful to see how the controlling expense accounts appear after the entries described above have been made to them. They are all substantially alike in form, and so only one of them is shown here. Because of the variety of the entries to it, the auxiliary manufacturing expense account has been selected.

AUXILIARY MANUFACTURING EXPENSE ACCOUNT

Stores journal (value of all stores used in the operation of any auxiliary manufacturing department. Credit therefor to the stores account).	to the payroll account.)
Worked material journal (value of all worked material used in the operation of any auxiliary manufacturing department. Credit therefor to worked material account).	Voucher register (amount of all indirect charges—from outside the concern—incurred in the operation of any auxiliary manufacturing department. Credit therefor to accounts payable account).
Payroll book (value of all labor employed in the operation of any auxiliary manufacturing department. Credit therefor	General journal (amount of fixed charges and miscellaneous charges incurred in the operation of any auxiliary manufacturing department. Credit therefor to various accounts).

This account and all other expense accounts must be closed at the end of the accounting period. The credit entry for that purpose is not shown here for the subject of the distribution of the expense is discussed in a subsequent article.

We left the detailed expense accounts in the form of a file of material issues, time tickets and bookkeeper's vouchers. At the end of an accounting period the file is taken and the various slips totaled for each account, each kind of slip by itself and the sums entered on a detailed expense card like that illustrated in Fig. 46. It will be noted that the groups of entries correspond to the entries made in the controlling accounts. The next step then is to total each class of

entry from the detail expense cards and compare the results with the entries made in the controlling account for that expense subdivision. If the two do not agree to within a very small amount, the sorting and totaling of the vouchers in the group should be checked to find out where the error is and, when found, it should be corrected.

It will be noted that it is not necessary that the sum of the distributed details should check with the total entered in the controlling expense account to the last cent. Such an idea is contrary to the commonly ac-

EXPENSE				GER		DEPT. M. D. M. YEAR 1922	
ACC'T.	SCHED.	JAN.	FEB.	PT.	OCT.	NOV.	DEC.
M.D.M.F.							
M.D.M.J.							
M.D.M.M.							
M.B.							
M.F.							
M.M.							

FIG. 47—EXPENSE LEDGER

cepted standards of bookkeeping which says that the subsidiary accounts must agree with the controlling accounts exactly. There are several reasons why this is not necessary in cost accounting, not only here, but in other places as well. It is frequently impossible to get the exact figures without a great deal of trouble. The wages earned, for example, on a particular job may give a fraction of a cent when the extension is made, and these fractional cents will almost surely throw the total off a little. In the second place, even if a small error does creep in, it is hardly worth while trying to locate it, for so many approximations are used in measuring both time and materials that the result can only be an approximation at best. Hence, a slight discrepancy has no real effect on the accuracy of the records. Large deviations should not be permitted to pass uncorrected.

The physical task of handling all the vouchers is very much reduced if a Burroughs duplex adding machine is employed. The machine is so arranged that figures can be totaled in one part of the machine, transferred to another and a second set totaled and likewise transferred. In this way the totals for each group of issues for a single account and the total for the account can be obtained at the same time.

The next step is to total all of the cards and see if the figure agrees with the sum entered in the controlling expense account for that group. If it does, it may be assumed that the detail expense cards have been added correctly and they can now be entered in the expense ledger.

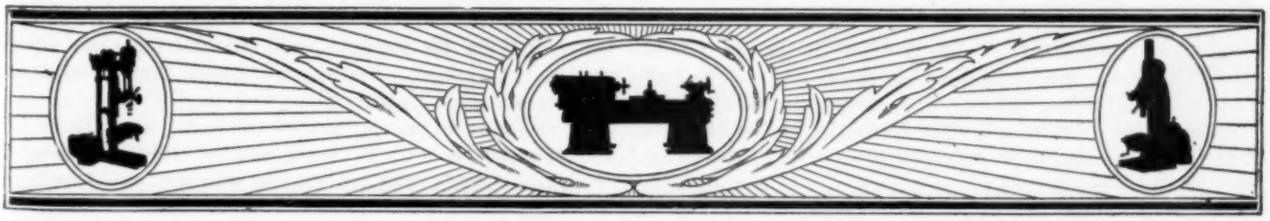
The expense ledger which is shown in Fig. 47 is distinctly different from the normal ledger form. It performs the service usually rendered by a subsidiary ledger and there is no reason why it should not be so called. There should be no hesitation in departing from traditional forms when it is perfectly clear that something is to be gained by so doing.

The ledger is arranged with one sheet for each department for an entire year. The totals of detail expense cards are entered against the symbol for the account in the column for the month in question. When that is done the column is summed up to give the total of the departmental expense for the period in question. All the ledger sheets for the expense group of departments should then be added, in turn, and the result verified with the controlling expense account. If the Burroughs duplex adding machine is used, then two operations can be done at once. The expenses are now ready to be distributed, a discussion of which comes in a following article.

There are several forms which the expense ledger could take, for it may be readily seen that several very interesting comparisons are possible. In the form shown, the expenses for the several months within any one year may be compared with each other and with the scheduled expense for the period. It would also be most convenient to compare the figures for each month with those for the corresponding month of the preceding year and of the year before that. The total expenses to date and for previous years for like periods would give a great deal of information for the guidance of a business. This is particularly true in the case of seasonal industries for in such instances it is normal to expect marked fluctuations from month to month, and hence the comparison of cumulated figures for a period with like periods for preceding years are more valuable as indications of the trend of the business than are the month by month comparisons.

To put all the information on one sheet would necessitate a very large sheet, or else a separate one for each department, and neither of these methods is very satisfactory. In the first case, the form is too large and in the second case too bulky to be easily used by the executive. The ledger, it must be remembered also, is one of the books of account and so it should not be allowed to wander from its proper place in the cost department for long periods of time. A better method, then, is to draw up the expense ledger in the form shown and then prepare a report each month therefrom for the executive, giving him the comparisons which he really wants. Such a method is much more economical, for more often the manager wants to study only certain particular accounts or departments, and if a report is prepared only those records which have significance in the control of the business need be entered.

It must not be thought that the methods outlined in the article are the only ones which can be successfully used, for many others have been devised that have given satisfaction. It must not be supposed, also, that the procedure given here will meet all needs; peculiar circumstances often need peculiar treatment. All that has been presented has been tried out and tested, and it unquestionably gives excellent control over the expense accounts through a wide range of conditions.



Methods of Design in a Small Shop

By A. W. Forbes

IT IS not the purpose of this article to give a general discussion on design in small shops, but merely to state methods which I have found useful, and to give a few of the reasons for their adoption. In some ways designing in the small shop is easier than in the large plant. The designer is helped by his constant contact with the production work. He is acquainted with the men and machines as well as the methods of the shop, and all these are large factors in design. On the other hand, a small shop cannot employ an expert in each line. In many cases the method of trial and error must be used where a simple calculation would produce the result much quicker, if there were anyone who knew how to make the calculation.

Some of this trial and error could be avoided by engaging a consulting engineer from the outside. However in that case it would be necessary to find a consulting engineer who knew the subject, and in general I

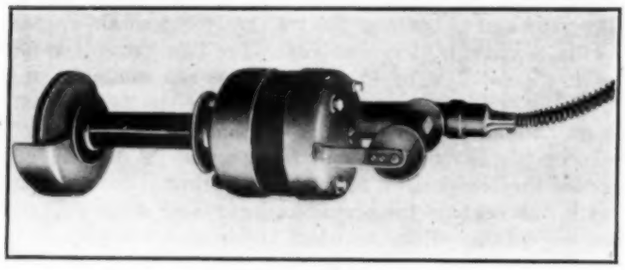


FIG. 1—THE GRINDER DESIGNED

think it easier to solve the problem than to select the man to solve it; that is in the large number of ordinary small problems. Neither would it be possible to find a consulting engineer familiar with the particular conditions under which the machine is to be manufactured and the applications to which it will be put.

I will illustrate with one of my recent designs, a portable electric grinder, Fig. 1. It was decided a few years ago that it would not be wise to enter a well covered field like that of portable grinders unless I could produce something that was an improvement on what was being sold, at least for certain applications. Burnt out windings, due to overloading the motor, are one of the commonest troubles with this type of grinder. While the trouble is usually due to the carelessness or ignorance of the operator, still a winding that would make care unnecessary in this respect would be an advantage, and it was decided to see what could be done to avoid the trouble. A few years spent in research in insulation made entirely of incombustable material produced the desired result.

A satisfactory winding that could not be burned out by overload being obtained, the next step was to secure bearings that would stand the same treatment. Oil was considered undesirable, as the bearings, located near the hottest part of the motor, would soon make trouble if neglected. A metal graphite bearing that requires no oil was finally selected by the method of trying all possible bearings and observing results. A graphite bearing does not have as long a life as an oiled bearing, but it is easily replaced and is not injured by heat or neglect.

The two main departures from standard design being determined upon, it was next necessary to consider the machine as a whole. It is sometimes said that one thing should be considered at a time. Very true, but it is also true that everything should be considered at once. The detail under consideration should be viewed in its relation to every detail in the completed machine, and life is too short to try all these points of relationship one at a time.

Such principles are more clearly seen in a sport like baseball. A pitcher must give every effort to the accuracy and speed with which he throws the ball. That alone is a complex study that requires all his thought and practice, but if he should happen to forget that there was a man on third base, there might be trouble. He must see the game as a whole, keeping all the details in mind, even when concentrating on the one point which needs special consideration.

A better illustration is found in the game of chess, though unfortunately not so many people are familiar with this game. It gives an excellent opportunity for studying mental qualities, because, while the two players are given absolutely equal opportunities, the problems are complex enough to thoroughly exercise the mind, and chance has been eleminated to as great a degree as possible. We find two contrasted types of players. One tries to study each possible move, following it up for several moves ahead. He considers one thing at a time, finally reaching a conclusion as to which is best. It makes a slow game and one that to me is uninteresting. The other type keeps the whole game in mind at once, or as much of the game as his mind has capacity to hold. He spends little time in looking at individual moves, seldom looking more than one or two moves ahead. I belong to the second class of players. It saves a tremendous amount of time, so that even in match games I have not often found it possible to use half the time allowed. An eight-year-old boy recently gave a

FIG. 2—DESIGNING PARTS OF TRIAL MACHINE

demonstration of his ability to win from experienced players, and he did it so quickly that anyone could see that he did not waste much time looking at individual moves. Both types of players win games so that we cannot say that one method is any more sound than the other, but if we were paying for the time we would prefer the second. Yet the very best players combine both.

In design the principles are the same, but there is a much larger variety of facts and principles that must be kept in mind than in even a complex game such as

chess. Even the exceptional eight to ten year old boy has secured but a small part of them.

There are all the questions of the strength of materials, stresses due to shapes of parts, wear, appearances, besides the particular functions the parts will perform in the given machine, the abuse they are likely to receive, the processes by which they are made, and in the small shop, even the men who will do the work. Any one question that the designer fails to keep before him when working on a particular detail. means a change in the design later, and there are so many points that it may mean that he will spend the rest of his life in making these changes.

Complete Designs Hard to Visualize

It is doubtful if anyone has the power to visualize the complete design of even a fairly simple machine like this snagging grinder. We can see each part by itself, and its relation to some of its neighbors, but not in proper relation to all the other parts and stresses which it must stand. Even in the case of the details that we can visualize clearly, there is often a better way that does not occur to the mind until a long time later. Drawings will help the visualization, more with some persons than with others. They extend the range of the imagination, but do not make it of indefinite extent.

It is for this reason that I recommend starting the construction of the machine fairly early in the process of design. After the main parts have been outlined a few sketches are made and the parts made from the sketches. In this preliminary machine expensive patterns are avoided, except where confidence is felt that there will not be extensive changes. It is cheaper to build up the parts under the acetylene torch. The machine will probably run, but it is not likely to be a satisfactory product. If there are many faults, it is probably better to start all over again. If only a few, then is the time to consult with others.

Two heads are better than one, and it might be claimed that some one should have been consulted before the construction was started. This might be true if there were two engineers or designers with experience in the line sufficient to advise each other without spending too much time over the subject, but in the small shop we do not often find two such men. The cheapest way to bring information about the design to those whom it is desired to consult, is to build a machine. Even if two engineers could be obtained who were well enough acquainted with the features of the machine to consult before building the first machine, it is doubtful whether much would be gained thereby. They would have so nearly the same prejudices that their work would be largely duplication. The man we need for consultation is one with a radically different point of view, and to make him understand, we need something more than ordinary drawings. There is one type of man whom I have found it useless to consult—the one who knows it all. He has certain ideas that must be accepted and adopted on his authority. In fact I have been told by experienced men who claimed to know, that I could not build any one of my grinders, using my present methods.

In the case of this particular snagging grinder, the first model was so evidently out of the question that I thought it best to start new. In fact it was over a year between the time the first machine was running and the time I had completed the sketches for a machine of design similar to the final product. This machine operated satisfactorily and if I were only making one machine for my own use I would have been satisfied, but it was still defective as a selling proposition. Certain parts would never stand the strains they were expected to receive. Others would throw out the machine on appearance only. I could have made other sketches and a new machine to correct the faults observed, but thought it better to get someone else to do this.

Not having a man connected with the organization who I thought would contribute the desired ideas to its development, I gave the machine and the list of faults observed to one of the boys in the shop (age 17), who had had several years' experience with shop work, both electrical and mechanical, and some tool work. He received instructions to correct the faults and make whatever other changes he thought would improve the machine, making a complete new grinder, except for such parts as he wished to use over as they were. He was given a younger boy to assist in making the parts, see Fig. 2.

Naturally I did not expect a perfect machine as a result, even though he did consult with me on a few of the changes. Some details had to be changed several times before I was satisfied to place the grinder on the market, but I got what I was after—a different point of view applied to the same problems. I doubt if the machine was any better than if I had made drawings for the changes necessary to correct the faults I saw, but it was in better shape from which to start the final refinements, which we made together in consultation with everyone we could find.

Sources of Design Data

There are a number of other sources of design data that should not be overlooked in a small shop. One is the salesmen, both those selling our goods and those selling to us. The former give us the point of view of the customer, and this is of value even when wrong. The latter do not often know enough about anything to amount to much, not even in their own line, but fortunately there are exceptions. If a salesman shows interest in my products I often take him out into the shop and show him the new things I am getting out. Sometimes he can show how the product can be improved by the use of his tools or materials. In that case he is doing his work as a salesman in a most satisfactory way for both parties. More often he brings new points of view which are of interest in a general way, but not specifically applied. It might be thought risky to show new ideas to salesmen from other firms, but I think the risk is slight compared with the benefits that may result.

Another source of information is time. I do not know how the time element works, but after consulting with all available persons on a problem, only to find that they have no suggestion that was not previously thought of, and after dropping the subject as settled, an idea will sometimes come that makes all other methods seem crude. I know from personal experience that these ideas sometimes come in dreams, although this is the exception. More often there is some suggestion like one of the numerous stories about Eli Whitney and the cotton gin, the one in which he conceived the idea from seeing a cat trying to pull a chicken through an opening in its coop, but only succeeded in getting feathers.

Time is the cheapest aid to design, for it consists in

elapsed time, not working time. It does not seem to interfere in any way with a full day's work in other lines. It works more effectively when the designer has temporarily forgotten the point to which it applies. The difficulty is that it holds up the work, and most of us wish to see our machines on the market. I have, on occasion, waited four to five years after the main features of design were determined upon, but do not like to do so.

As for the results of these methods my grinders have a unity of design that is often lacking in those of my competitors. This results in ecenomy of construction, as well as greater service for the applications that were considered in the design.

Keeping Countershaft Clutches in Condition

By George Walter
Millholland Machine Co., Indianapolis, Ind.

HAS the day of opportunity passed? Or will there be someone, some day, who will invent the perfect friction clutch for a countershaft? There are many friction clutches in service which have operated successfully for a number of years while others have been a failure from the start regardless of the fact that they were of the same make and design.

The principal fault in friction clutches as applied to countershafts seems to be a lack of ample clearance. Another of less consequence is insufficient oiling facilities. For example, friction clutches are used with entire success in the headstocks of modern turret lathes and the new types of geared-head engine lathes. There power is positive, control is instantaneous and reliable. They never stick because the spider, traveling upon the shaft or spindle, is always in the clear. Their only chance of binding is upon the shaft bearing due to lack of oil. This trouble is seldom experienced because as a rule they run in oil.

The spiders used upon countershafts are usually of the expanding type and very little clearance is allowed. Another type is that of the contracting band. In both cases these parts are secured to the countershaft with keys or setscrews and operated by cams. Because of the proximity of the moving parts heating results, they bind and the cam becomes a superfluous bit of equipment. In this case, oil applied direct to the friction may remedy matters for a few hours but seldom for a longer time.

Frictions have been designed where greater clearance was allowed, the moving parts being held in place by springs. Due to vibration, however, it was with difficulty that these springs were held in place. Hence this type has never been very widely used. The most popular type seems to be that of the expanding cast-iron spider depending upon no outside agency to contract it when the cam is thrown out. In time this type loses its elasticity and becomes uncontrollable.

The Flat Disk Type

Another popular type is that of the flat disks. When first installed this type seems to be very good. Soon, however, the disks become worn smooth and cling to each other tenaciously. Oil applied direct serves only to aggravate matters. Lack of it results in blue fire and smoke.

Why cannot the same principal used in machine tools be applied to the countershaft? Because a minimum swing of the shifter lever is desired and a complicated mechanism overhead is not wanted. Therefore we must do our best to make our present type of countershafts do the work and with proper care from the start and with proper foresight they can be made to do fairly well.

The oil holes provided upon most clutches are far too small and soon become stopped up, yet it is essential that they be oiled regularly from the very first day of operation. No matter what the hurry a stopped-up oil hole must be unstopped promptly if a call on the repair gang is to be avoided. It is a good plan to use oil direct upon the spider from the very first even though operating instructions do not say so. It can do no harm and may save a big repair bill. A spare oiler, familiar with the shop, should always be on hand because friction clutches will not wait for a new man to become broken in.

The Importance of Alignment

Take time to align your countershaft with precision. A 4-in. belt may be running upon a 4½-in. pulley and yet be out of center. This belt will then have a tendency to pull the pulley on an angle, wearing the bearing away on one end. In a short time this allows the friction to come into contact with the spider and control becomes impossible until the pulley is taken down and bushed.

Temporary repairs may be made in the above case by moving the spider back a short distance on the shaft, but the increased expansion has a tendency to cause a fracture of the part with resultant danger to the operator of the machine.

When disk frictions begin to cling, a good remedy is to slot them so as to divide up the contact surface. I recently repaired a friction of that type as follows.

The disk attached to the pulley I placed to one side as it was. The other I placed in a milling machine and with a saw milled grooves 0.015 in. deep and 0.025 in. wide across the face of it, ¼ in. apart. Then I sawed similar grooves at right angles to these. The disk was then placed upon the magnetic chuck of a Heald ring grinder and roughed up. The entire job required less than two hours and the countershaft has never given any trouble since. Oiled once a week it pulls a capacity load every day.

After all, oil is the main consideration. Few countershaft clutches require oiling more than once a week if well taken care of from the start. Reservoirs are usually supplied inside the pulleys but owing to the small holes leading to them they are difficult to fill. Patience is often not the gift of an oiler, and often too little time is allowed him to do the work whether he is willing or not.

Friction clutches still seem to be a necessity because the shifting belt is too slow and the geared countershaft will not stand up under constant shifting on heavy loads. Whether the day of fool-proof clutches will arrive before all machine-tool manufacturers change over to the direct motor drive is a question. But under present conditions existing types can and are made to operate successfully when given the proper attention beginning with the first day of service.

The Czech Automotive Industry

BY HENRY OBERMEYER AND ARTHUR L. GREENE

The difficulties that check automotive growth — Foreign competition and the protective tariff—Potential market for the medium-priced car—The future of the industry

THERE ARE many ways of judging, superficially at least, of the prosperity of the country. Up to a certain point increased purchases of a luxury article, such as a pleasure car, represent better wages, better living conditions and general prosperity on the part of a people. After a certain point, however, which point some financial experts claim the American people have already reached, increased purchases of luxuries represent not increased prosperity of a people, but a gamble and hysteria for pleasure which represents mortgages on property, the accumulation of debts and an ever lengthening roll of bankruptcies.

In the case of the automobile and motor truck industry of the new Republic of Czecho-Slovakia it becomes evident that purchases of these commodities have not yet reached a stage where the State need fear any such evils. On the contrary purchases of pleasure cars have remained at practically the same level as of a year ago, although orders for motor trucks and motor plows have been on the increase; construction and design of motors and bodies have undergone no radical changes; none of the lighter and cheaper models so common in our own country have been put on the market by any of the four automobile manufacturers of the country; mass production, as in England, remains in the minds of automotive manufacturers more of an evil than a blessing; and the automobile owning classes are confined, as in our country a score or more years ago, to persons of wealth and means.

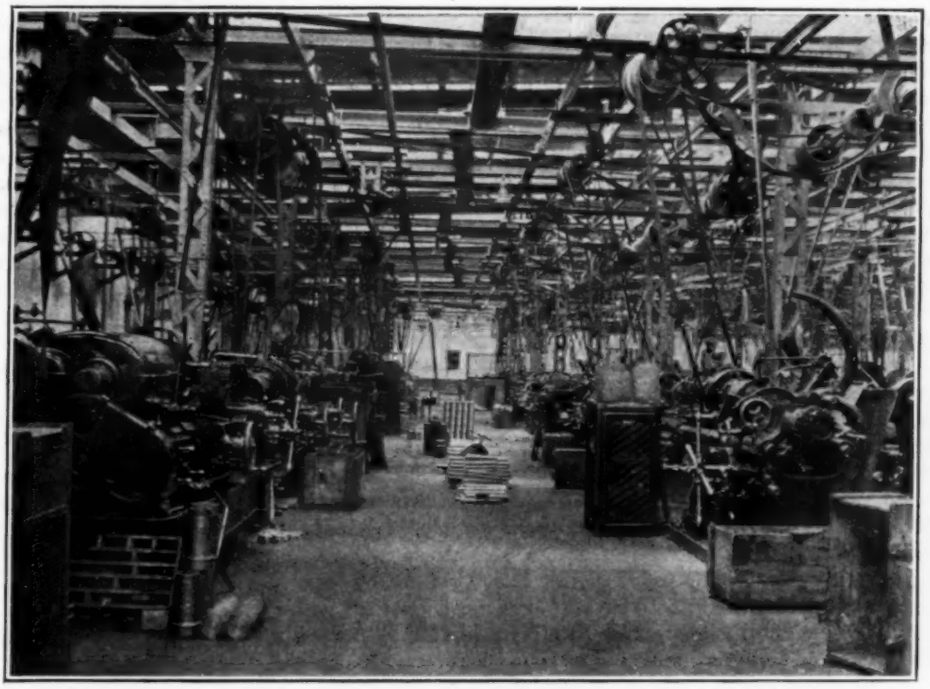


FIG. 1—A MACHINE SHOP IN AN AUTOMOBILE DEPARTMENT

But while this statement of conditions might seem to indicate backwardness and lack of progress on the part of the automobile manufacturers of the Czech Republic, there are many reasons to account for the conditions as found there today and which, after all, do not mean either retrogression or a standstill in production. While believing in standardization of production to a much greater extent than is ever found in England, but at the same time to a much less degree than is found in our own country, the Czech automobile manufacturer, like most of his European compeers, still believes in the cardinal virtues of endurance and quality over that of mere mass production, believes in distinctive characteristics of his body construction and has consistently refused to manufacture a motor of more than four cylinders. He likewise believes in protection of home industries to such extent that the State of Czecho-Slovakia has one of the highest import duties on foreign cars of any country in Europe.

It might be supposed that the automobile industry of Czecho-Slovakia would be in much the same precarious position as that in which similar industries in other countries of Europe found themselves after the war as a result of extended plants with increased production and with more limited export trade. It might, again, be conceivable that long established industries upon finding themselves entrenched in a new country of much smaller area would feel the effects of a restricted internal trade much more than would the industries of other countries with their own consuming population undisturbed. The logic of such an interpretation falls down in the present instance for several reasons. First of all the present lands of the new Republic, most of which constituted parts of the old Hapsburg Empire of prewar days, did not contain the main automobile indus-

tries of that country. For that reason the four automobile industries that found themselves included in the new Republic after the boundaries had been determined upon were not among the category of other industries which were too numerous to supply the more limited needs of a decreased population. And of the four automotive manufactories only two of these, it might be mentioned, are of appreciable size.

As for regaining export trade to former parts of the old Empire, the automobile industry found itself placed, both geographically and politically, in a favorable position. Much of the territory left to present-day Austria includes an appreciable number of the major automobile manufactories of the old Empire, while those sections of the Empire which were divided among Poland, Roumania and Jugo-Slavia maintained but an insignificant number of this class of manufactories. In view of the political agreements which have united these two states, including Czecho-Slovakia, in a military alliance against their neighbors, it has been comparatively easy for the automotive manufacturers of the Czech state to regain what has been left of the trade to these countries, a trade, which though greatly reduced, was before the war divided among all the competitors in the old Austrian State.

Difficulties that Check Automotive Growth

But despite the comparatively favorable position in which the automotive industry found itself after the war, the difficulties which have had to be met, some of which still confront the industry in greater or less degree, are of appreciable size. Among the major difficulties might be mentioned competition with German manufacturers, as well as with Austrian industrials; difficulties of obtaining raw materials abroad combined with excessive prices; increased selling difficulties both internally and abroad because of decreased purchasing power of the people; high costs of operating automobiles because of scarcity of gasoline and oil; an extension of French competition to the main fields of Czech export trade, namely the Balkan States, and high tariff walls erected by neighboring nations against the importation of automobiles, trucks and plows.

Just how these factors have retarded the more speedy return to normality of the automotive industry of the new Republic is perhaps worthy of note. Of paramount importance to the industry after the war was the increasing importation of German and Austrian automobiles into the country. The Government immediately after its inauguration raised a tariff barrier against foreign importations of automobiles, motor trucks and farm implements, the tariff being based on a 75 per cent ad valorem duty. With the steady depreciating currency of the German and Austrian republics, however, the ad valorem duty was soon found to be an insufficient stop-gap in keeping out the cars and motor trucks manufactured in these countries. The duty was therefore changed to a specific one, whereby each make of car was taxed separately on its selling price within the country and not, as heretofore, on its cost of manufacture in the exporting country.

This method has been found to operate quite successfully. The rates are changed from time to time as the costs of manufacture of the foreign cars decrease or increase and as the selling price within the country changes. With the passing of each month, the likelihood of German manufacturers capturing any of the internal Czech trade for themselves grows less and less as the price for raw materials steadily mounts and with it the selling price of the finished product. And with existing high railroad transportation costs from the Atlantic coast to the interior of Czecho-Slovakia, combined with the high tariff walls, Czech industrials claim that any fear of an influx of American cars and trucks is groundless. At least so it has proved up to the present time.

A very serious problem which has not decreased to any appreciable extent the past year, is still to be found in the securing of certain raw materials for automobile manufacture, not so much iron and steel, of which the country has quite sufficient for its needs, but more particularly wood and rubber. Together with this problem of importing necessary raw materials there has gone hand in hand the accompanying difficulty of ever rising prices for iron, steel, rubber, wood and coal. Even where importations from outside sources have not been necessary, such as in the case of iron, steel and coal, the Czech manufacturer buying these products from his own mines has been faced with ever increasing prices. One reason for the many advances made in the domestic market for these items has been the demand from surrounding nations for these products, so that the Czech industrial has had to compete in purchasing with industrials of Austria, Jugo-Slavia, Poland and Roumania.

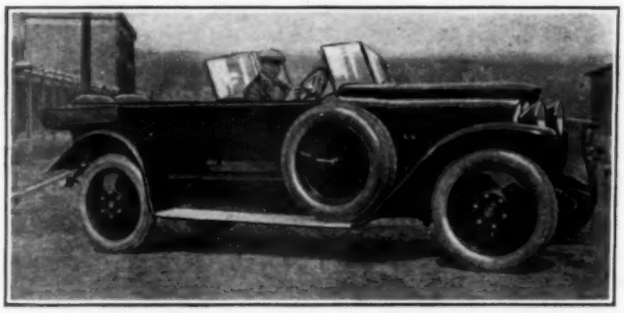


FIG. 2—THE LIGHTER TYPE "MIGNON" MOTOR CAR

With respect to the next two problems, namely decreased purchasing power of the people and high running expenses of cars and trucks because of scarcity of gasoline and oil, we come to what is perhaps the main reason for the conservatism in manufacturing, both with regard to construction and weight of motors installed and to construction of bodies. In Czecho-Slovakia there exists no middle ground for the man with a moderate salary to purchase an automobile for purely pleasure purposes and hope to maintain it with present high operating costs. For this reason, the Czecho-Moravian Co., the largest manufacturer in the State, as well as other automobile manufacturers of the country have made no attempt up to the present to produce a medium weight car at a medium price. It is true that in the early years of their founding, this company did manufacture a light four cylinder car, but after a year's trial this type of car was abandoned for that best of business reasons, no sales. Since that time, this company, which is a true criterion of conditions in general in the automotive industry of the country, has made only two standard types of pleasure cars, both of heavy weight and high horsepower. In their truck department they have specialized on three standard types of hauling motor trucks, two of gear drive and one of chain drive.

The production of automobiles in the Czecho-Moravian Co. has not been kept down because of lack of

equipment in its machine shops, one of which is shown in Fig. 1, but on account of the high operating costs and low wage schedule paid the workers. For instance, the estimated cost of operating the lighter Mignon car shown in Fig. 2 including garage, chauffeur, oil and repairs is approximately 65,000 Czech crowns per average run of 16,000 km., or about 4 crowns per km. When it is considered that the workers in this industry, an industry that ranks high from the viewpoint of wages, receives 10 or 11 crowns per hour, there is little cause to wonder that the automobile plays but little part in the life of the working man. In matters of gasoline and oil, there is sufficient reason to be found which would make the maintenance of an automobile by the working man a practical impossibility. Czecho-Slovakia produces but little of these products so that practically all consumed by the country is imported. The prices for gasoline average about $1 per gal., and motor oil costs are considerably higher.

Competition by French automobile manufacturers in the countries forming the Balkan States is beginning to assume somewhat the same fearsome proportions for Czech industrials in this field that German competition has assumed for industrials of other nations in export trade. For the Czech automobile manufacturer, this competition by his western political ally has been harder to meet than any other difficulty with which he has yet been confronted. It has meant the choice of two evils, either of which might be disastrous for the maintenance of the country's independence from surrounding enemies. Politically close allegiance with the French is looked upon as the mainstay of Czech independence. From a trade viewpoint, however, competition with the French is fraught with potential evils for the growth of the Czech industries and the extension of export trade to neighboring countries. How to reconcile political allegiance with trade competition is a problem which threatens, if unsolved, to bring many difficulties

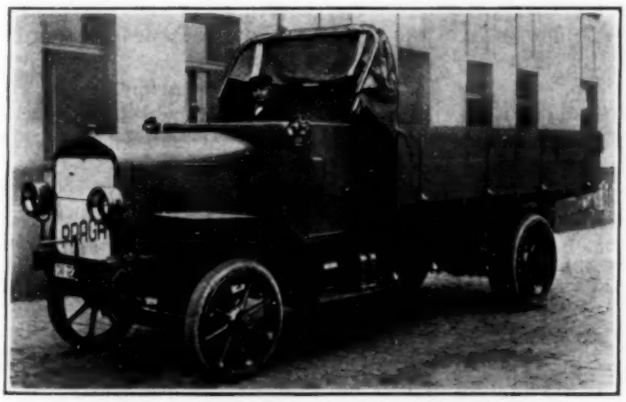


FIG. 3—THE PRAGA TYPE N 5-TON MOTOR TRUCK

to the fore for the Czech industrial within the next few years.

On the subject of protective duties erected by the countries of this section of Europe, perhaps less need be said. The one un-economic factor that seemed to govern all legislation on this score by all the states concerned, was that protection was not only necessary for the infant industries already established, but that it was also necessary for those industries which it was hoped to establish in the course of time. The government of Czecho-Slovakia was not behind other nations, it is true, in establishing these barriers to international trade and commerce, but in its own particular case, and especially in the case of automobile industry of the country, these barriers, which were originally erected to keep out the products of German industries, have been detrimental to the steady establishment of a large export trade. The high import duties erected by the neighboring nations of Czecho-Slovakia have hit the export trade of passenger cars to those countries especially hard, so much so, that today of all pleasure cars manufactured by the four automobile industries of the country, only 10 per cent of the total goes to foreign countries. In the matter of export trade of motor trucks and motor plows the situation has not been

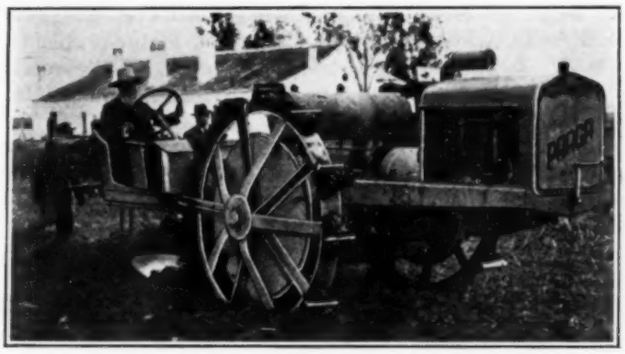


FIG. 4—THE PRAGA TYPE K MOTOR PLOW

nearly as difficult to meet because the automotive industries of the new Republic have what is almost a monopoly of these products and importations have been needed by Poland, Roumania, Bulgaria and Jugo-Slavia. In the Czecho-Moravian Works, of a total output per year of 500 motor trucks and motor plows, fully 50 per cent of this number goes into export trade to the Balkan States, Spain and Africa.

In this particular field, the Czecho-Moravian Co. is unquestionably the leading industrial unit in the country and at the time of writing is working at full time and has sufficient orders on hand to keep it employed for the next twelve months to come. In view of the widespread industrial slump that prevails among the other major industries of the country, the present production maintained in this one department is nothing less than remarkable.

The three standard types of motor trucks manufactured by this company are known as the Praga, type R, type N and type V. The first two types mentioned are gear driven and have a capacity of 2 to 2½ and 5 to 5½ tons respectively. The latter, type N, is illustrated in Fig. 3. The type V motor truck is chain driven and has a capacity of 3 to 3½ tons. Of the two types of motor plows manufactured by the company, known as Praga, type X and type K, the former which has a motor developing 20 hp., is manufactured chiefly for export trade to Spain and northern Africa. The type K, shown in Fig. 4, is of larger capacity and has a motor capable of developing 40 horsepower.

But while the truck and motor plow departments of this company might be called self-sustaining so far as maintaining production and export trade is concerned, because of the accelerated demand for these products in central and eastern Europe, as well as in more distant countries, the passenger car department has been not only unsuccessful in increasing its sales over last year, but has had difficulty in maintaining its earlier production figures. According to one of the directors of the

Czecho-Moravian Works, little hope is placed by automotive industrials on an early expansion of curtailed post-war export trade. At the same time, however, passenger automobile manufacturers in Czecho-Slovakia do expect a decided increase in purchases from their own consuming population within the next twelve months.

Fewest Cars per Capita

It is the claim of automobile manufacturers of the new Republic that Czecho-Slovakia maintains fewer passenger cars and a less number of automobile manufactories per capita than any other country of like size in Europe. In a total population of 13,500,000 there are only two large automobile manufactories and two small ones, while the total number of motor-propelled vehicles in the country, including trucks, is scarcely 17,000, a number which is less than that at present in Morocco. Of this number about half come under the heading of trucks. According to these figures, therefore, there is being operated in Czecho-Slovakia today only one passenger car to every 1,590 persons. Compared with the number of passenger cars being operated in the United States, which late figures give at 10,600,000 for the country, or about one to every ten persons, this number dwindles into insignificance.

The one important fact to be gleaned from these figures, as far as the automobile manufacturer of Czecho-Slovakia is concerned, is that a practically unlimited field presents itself at the very door of the manufacturer to increase home consumption. The question remains then, how to bring these potential customers into the market.

The Entering Wedge

In view of what has gone before and because of the many economic difficulties facing the country, it might be supposed that the present would hardly be an auspicious moment for the introduction of a medium-weight car selling at a medium price. While admitting that the time is still premature to permit the successful sale of a very low-priced car such as the Ford, because of the very real poverty existing among that class of people who would normally constitute the largest class of purchasers, automobile manufacturers of Czecho-Slovakia claim that there does exist at this time a wide class of professional men and merchants, such as doctors, real-estate men and salesmen, who need a medium-weight car for business purposes and who would come into the market if a car combining the desired qualities of medium weight and medium price were put before them. And while the number of sales that could be made among this necessarily limited class of professional men would not create any great immediate boom in the industry, it would constitute, manufacturers believe, the entering wedge for the more widespread use of the automobile both for pleasure and commercial purposes.

Mass Production Will Follow

The mere fact that there exists this type of professional man in Czecho-Slovakia that is demanding today something less expensive to operate than the ordinary heavy passenger type of automobile is clearing the way, manufacturers say, for the gradual introduction, even though it may take years to come, of the so-called popular-priced car. And with the introduction of this type of car, there may be expected to follow many of the phases in automobile manufacturing that are so common, and so often condemned by economic and financial experts in foreign countries, among our own automotive industry—namely, mass production on a large scale and the increased centralization of parts.

From what has been said, it is perhaps obvious that the best years of the passenger automobile industry of Czecho-Slovakia lie in the immediate future. There exists at this time no such state of affairs as we are accustomed to hear of in our own industry, of a saturation point being reached in the next twelve months, nor is the industry threatened with an accumulation of a large surplus. In short the strongest factors in the automotive industry of Czecho-Slovakia today forecasting improvement, so far as increased sales of passenger cars within the country itself is concerned, are that production has never been forced above demand, that there exists a big potential market for a medium-priced car, while to meet this demand, there exists only a small number of manufactories capable of meeting the requirements. Bearing these facts in mind, it is not to be doubted that the automotive industry of Czecho-Slovakia today stands in a unique and enviable position as compared with her numerous and varied sister industries.

Book Reviews

A Symbol of Safety. By Harry Chase Brearley. Two hundred ninety pages, 6x9 in., board covers. Illustrated. Published by Doubleday, Page & Co., New York City. Price $2.50.

An explanation and description of the motives and work of the Underwriters' Laboratories, a corporation established and maintained by the National Board of Fire Underwriters. A reading of this well-written book will convince manufacturer, seller and buyer of the importance of the work done by the laboratories and of the value of the label.

Following the 247 pages of the book proper are several appendices that explain the requirements and tests of the laboratories and give information about labels, procedure for inspection and other divisions of the work, and reproduce a typical standard.

The Modern Iron Foundry. By Joseph G. Horner. Two hundred and fifty-two pages, 6x9 in., cloth boards, illustrated. Published by Oxford University Press, American Branch, New York City. Price $5.

A description of English practice, comprehensive and well-written. Because it tells the "why" of things, it should be valuable as a reference book to foundrymen, apprentices and students. In addition to the treatment of all of the practical iron-foundry subjects, there is a very good chapter on die castings.

National Health Insurance in Great Britain.—Bulleletin No. 312 of the Bureau of Labor Statistics, Department of Labor, is a study of the operation of health insurance in Great Britain for the ten-year period from 1911 to 1921. It embraces 103 pages and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, at 15 cents per copy.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Continuous Milling Fixture for Spring Shackles

By G. H. Simon

In milling spring shackles for motor trucks in a plant where the production was not great enough to warrant the expense of special machinery or elaborate fixtures, the milling time was reduced more than one-half by the use of the simple fixtures shown in the accompanying sketches. Two fixtures were used on the table of a plain milling machine, the fixtures being placed far enough apart so that the operator could unload, clean and reload one fixture without risk of injury from the cutters at work upon the other.

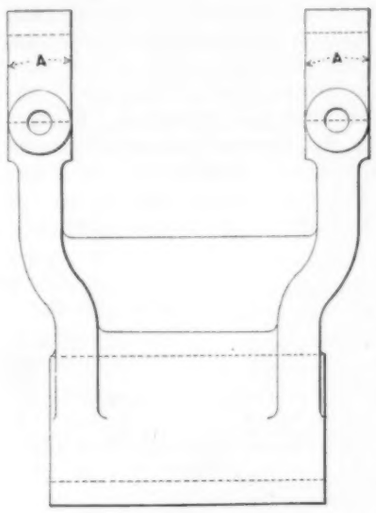


FIG. 1—SPRING SHACKLE TO BE MILLED

A plan view of one of the shackles is shown in Fig. 1. The hole in the hub is bored and reamed and both ends of the hub faced upon a turret lathe. The milling operation finishes the four faces *A* with two pairs of straddle mills working simultaneously. The previous method had been to set eight shackles upright in a single fixture and allow the cutters to pass over the whole length of the row.

The new fixtures, plan and elevation of which are shown in Fig. 2, were designed to take two shackles each, the pair leaning toward each other at an included angle of 60 degrees. Plugs *A* pass through the sides of the fixture and through the bored and reamed holes in the hubs of the work pieces. Between the arms of each shackle is a web, and this web rests against the hardened end of a plug in the fixture to sustain the pressure of the cut.

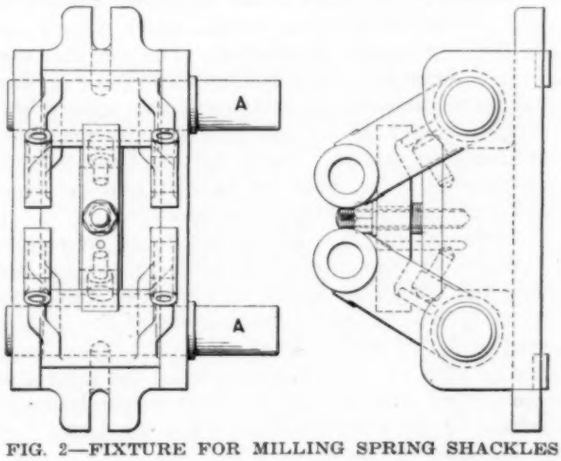


FIG. 2—FIXTURE FOR MILLING SPRING SHACKLES

The webs also provide a place for the double-end holding clamp, through which extends the single stud-bolt that furnishes the pressure to hold the work. The under surface of the clamp is shaped to hook over the webs, and an elongation of the bolt hole allows the clamp to adjust itself to any slight irregularity of the work pieces. A coil spring under the clamp serves to lift and hold it out of the way when the nut is turned back.

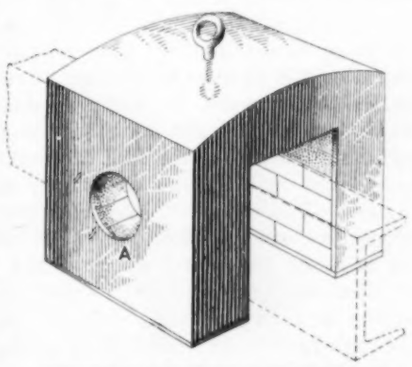
When one fixture is loaded, it is centered under the cutter arbor and the vertical feed thrown in, allowing the cutters to feed straight down until stopped by the knock-off. Meanwhile the operator can be preparing the other fixture. A quick traverse of the milling machine table enables the change in position of the cutters from one fixture to the other to be made without delay.

Portable Muffle for Heating Car Frames

By I. B. Rich

The building of some special car frames in the shop of the General Iron Works, Denver, Colo., required several bends in the frame in order to give clearance for the car truck wheels. As these are short bends requiring purely local heating, portable muffles were made, as shown in the accompanying illustration. The muffle consists of an outer case of perhaps $\frac{1}{8}$ in. sheet steel welded up into the box-like form shown, and having a round opening cut at *A*, through which the flame of a large oil burner can be introduced in order to keep the flame at that particular point.

Openings are also cut at each end, so that the whole thing may be placed over the beam in order to retain the heat as much as possible. The inside of the muffle is lined with firebrick, which fits around the opening and is held in position by strips welded across the lower ends of what may perhaps be called the jaws. An eye-bolt welded in the top of the case enables the muffle to be lifted by a small portable crane, so that it can be easily handled while hot, and be quickly removed when the beam has reached the proper heat for bending.



A PORTABLE MUFFLE FOR LOCAL HEATING

Metal Cutting Tools—Discussion

By F. W. Elstub
Alfred Herbert, Ltd., Coventry, England

The article by W. E. Splain under the above title and published on page 663, Vol. 58, of the *American Machinist*, deals with a very complex subject in a very simple and clear manner but in the scope of a two-page article it is impossible to cover the subject adequately. Mr. Splain quotes Taylor as being the best authority on the subject of metal cutting. Taylor's work, although it embodied the experience of twenty-odd years, was, and is, certainly very valuable, but it was based on conditions that have now been entirely superseded. In Taylor's day, grinding was a mere polishing operation; today the modern grinding wheel will remove metal in a way undreamed of in his time.

We have based our doctrine on the fact that it is now easier to grind a tool to shape from a piece of straight, black bar than it is to forge it. Thus, the Taylor principles and ours are diametrically opposed—the one says forge to save grinding, the other says grind to eliminate forging. Which is the better can safely be left to the common sense of your readers.

We agree with Mr. Splain that the clearance angle on an ordinary lathe tool should rarely or never exceed six degrees. We would even go further and say that the tool before the hardening should be roughed out with six degrees of clearance but after hardening the tool should only be touched on the grinding wheel near the cutting edge, thus making the actual clearance angle even smaller.

We do not agree, however, with Mr. Splain's preference for the round-nosed tool. It absorbs too much power in distorting the chip and it has not the life of a straight-edged tool under similar conditions. It has been proved by Dempster Smith, of the Manchester School of Technology, that the maximum cutting speed and tool life are obtained when the cutting edge is straight and has a nose radius just sufficient to enable the point to stand up, say $\frac{1}{8}$ in. radius on a cut $\frac{3}{8}$ in. deep with $\frac{1}{32}$-in. feed. (See page 53, Report of Lathe Tools Research Committee, 1922, issued by the British Government, Department of Scientific and Industrial Research and published by H. M. Stationery Office, London).

In the roughing tool for which we have a decided preference, the nose radius should be approximately half the depth of cut but rather under than over.

There is another point not mentioned by Mr. Splain that we think is of the highest importance. We refer to the hollow curving of the top face known as curved rake. On the continent of Europe this type of tool has a very strong vogue, but it has not been adopted so freely in Great Britain nor, as far as we know, in America, this in spite of the fact that it possesses many marked advantages for turning steel and other non-brittle materials. No doubt the non-adoption of this tool has been due to the lack of facilities for producing tools with curved rake to known and predetermined angles. This disability has been removed by the use of a conical-shaped wheel while the tool is passed across the edge of the wheel at an angle, thus forming an elliptical-shaped curve on the tool nose. From calculations and experiments, definite rake angles at the cutting edge can be produced by a specified combination of tool settings.

It has been proved to the satisfaction of many users that curved-rake tools absorb considerably less power than equivalent straight faced tools. It is to be deplored, however, that there is no actual evidence available of the amount of power saved.

The ideal tool for any operation will:

1. Cut at the highest possible surface speed.
2. Need the least regrinding per work done.
3. Increase output.
4. Use the minimum amount of power.

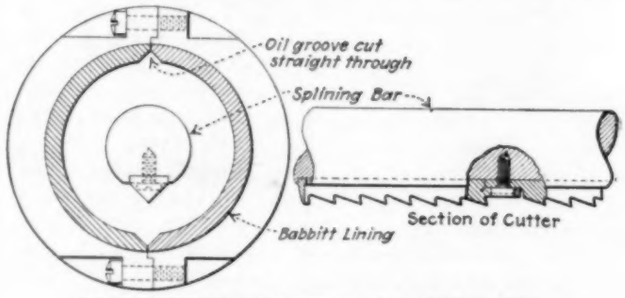
The information that will help us to find the "right tool" will be absolutely invaluable and we trust that your pages will always be open to the "right" kind of information.

A Few Points About Bearings

By H. R. Fowler

A certain amount of hand work is necessary in the production of high grade bearings, but from the standpoint of cost it is desirable to cut out as much of it as possible.

We used to take our bearings apart after boring them and mill each edge separately with a formed cutter to relieve the corners and provide grooves or pockets for the oil, but upon putting the halves together again we would sometimes find that they did not match. Finally we got the idea of using the keyseating machine to do the work by clamping the halves together, standing the bearing on end and planing a suitably shaped groove along the joint after the manner of cutting a keyway.



OIL-GROOVING BEARINGS IN A KEYSEATER

When we had finished one joint we would turn the bearing halfway round and treat the other joint in a similar manner.

The scheme worked very well indeed until we came to groove bearings that were more than 8 in. long, when we found we had exceeded the limit of the stroke of the machine. We then made a set of cutters as shown in the accompanying sketch, which served the purpose for any length of bearing. The cutters were made in 4-in. lengths, to avoid complications in hardening, and were rabbeted to overlap at the ends, where they were fastened to the splining bar by means of countersunk-head screws. These cutters have been in use for several years, both on babbitt and on brass bearings, and have proved very satisfactory.

This form of oil-grooving, with the groove going clear through, is undoubtedly the best for general use, whether ring, splash or forced oiling systems are considered, as it facilitates the washing out of the bearing by a continuous supply of fresh, cool oil. There is no tendency to gum up, as is the case when the oil groove comes to a blind end. It also provides an ample supply of lubricant to the thrust collars, when the latter bear against the ends of the boxes.

A point that is often overlooked in the cutting of oil grooves is that the edges should be rounded over, which helps the oil to get between the rotating shaft and the surface of the bearing; otherwise the sharp edges are likely to scrape the oil off the shaft. Merely breaking the corners of the groove is not enough—there should be a good generous round. It will not hurt the bearing any and it may help considerably toward cool running.

Oil-throwing on high-speed machinery is a difficult thing to overcome when ring oilers are used, as it seems as if the rings, as they bring up the oil, create a slight pressure which causes the oil to spurt out from the ends of the bearings. This trouble can be remedied to some extent by milling a vertical groove of generous size across the ends of the lower half of the bearing, allowing the surplus oil to get away more quickly and, incidentally, washing out the bearing more thoroughly.

Automobile Piston Clearance–Discussion

BY OTTO M. BURKHARDT

On page 344 of the *American Machinist* I notice a chart by D. P. Muirhead. This gentleman gives a clearance above the top ring of 0.009 in. for a 4 in. position. This amount is altogether too little for an efficient engine, as can be proven by the following calculations.

The piston head temperature is, according to some authentic experiments carried on by Mr. Jehle of the Aluminum Company of America, in the neighborhood of 800 deg. Fahr. The coefficient of expansion for cast iron is approximately 0.0000067 per degree Fahr. per unit length. Assuming the cylinder wall temperature to be 200 deg. Fahr., we have a temperature difference between cylinder and piston of 600 degrees.

For a piston 4 in. in diameter we would obtain a total expansion of the piston relative to the cylinders of,

$$0.0000067 \times 600 \times 4 = .016 \text{ in.},$$

or very nearly twice as much as allowed for on the chart.

The skirt clearances given by Mr. Muirhead are very good when applied to pistons with some flexibility, such as are now in vogue on high-grade cars. The calculation just given should be used exclusively for determining the clearances on the upper lands. The equation is also applicable for determining the clearance for piston rings, only with the difference that piston rings do not get quite as hot as the piston top. The writer has found that 500, 400 and 300 deg. temperature are properly to be assumed for the three rings, enumerating them in the order of their location, from the top downward to the skirt.

Supplementary Statement

In the article, "Using the Offset Drill Arm," Vol. 58, page 883, of *American Machinist*, mention was made of an offset drill arm being used in connection with a Pawling & Harnischfeger drilling and boring machine at the plant of the Allis-Chalmers Co., Milwaukee, Wis. The reader would naturally infer that the drill arm was manufactured by the Pawling & Harnischfeger Co., but as a matter of fact it is the drill arm of the Harris Engineering Co., of Bridgeport, Conn.

This article brings up an unusual condition in that both the Harris Engineering Co. and the Pawling & Harnischfeger Co. manufacture offset drill arms. The author, A. Becker, did not realize that situation.

A Lead Compensator

BY HERBERT M. DARLING

In making taps and hobs, it is necessary to allow for the shortening of the lead caused by shrinkage in hardening. This shrinkage is usually about 0.0015 in. per in. of length. To produce a tap that will have a correct lead after being hardened, the threading lathe must be fitted with a lead-compensating device. In most tap factories this device is quite elaborate and expensive, but the one illustrated herewith was made at very small expense.

Recently I had to make a set of short master lead-

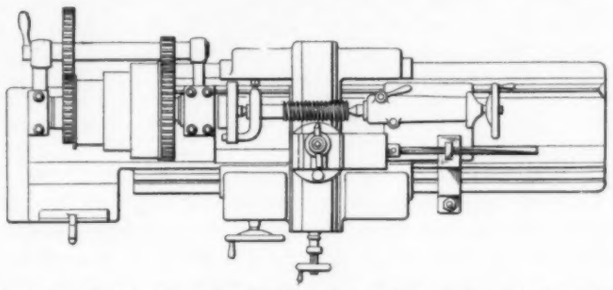


FIG. 1—PLAN OF COMPENSATOR ATTACHED TO LATHE

screws for a special tap threading machine. The screws were to have an increase in lead of 0.0015 in per in. so that the taps would have that same allowance for shrinkage. For threading the screws, I made the "lead stretcher" shown in Fig. 1, and in detail in Fig. 2. The dimensions given are suitable for its use on a 16-in. Hendey lathe. In use the bracket *A* is clamped to the front V of the lathe, the compound rest being swung around parallel to the center line. The handle of the compound-rest screw is removed and the coupling *B* attached in its place. The swivel block *C* is adjustable to a position in line with the compound-rest screw. The shaft *D* is a free sliding fit through the swivel block and has a floating connection to the coupling *B*. Shaft *D* has a right-hand $\frac{1}{8}$-in. keyway cut spirally with a lead of one turn in 66.6 in. A $\frac{1}{8}$-in. pin is driven into the swivel block and enters this keyway. The compound-rest screw is ten pitch or one turn in 0.100 in. When the lathe carriage is moved forward the shaft *D* will turn slightly and, in turn, will move the compound-rest screw. If the carriage moves one

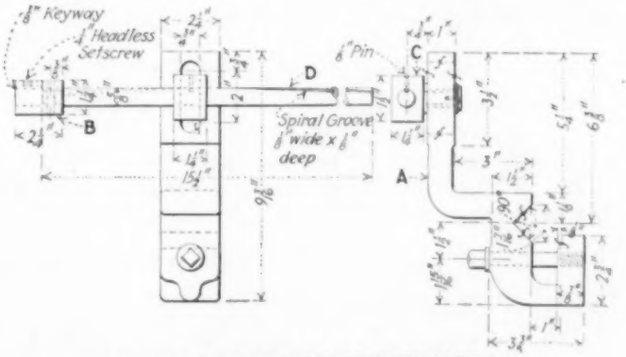


FIG. 2—DETAILS OF COMPENSATOR

inch, the compound rest will be moved 0.0015 in., and in threading, the tool will be advanced 0.0015 in. by the compound rest, for every inch the carriage advances, and therefore will cut an increased lead of 0.0015 in. per inch on the work being threaded.

Making a Tapered Helical Reamer

By J. Davies

I have looked in many handbooks for formulas to use in the calculations when making tapered helical reamers, but without finding anything very definite, so I was driven to the necessity of fixing up some rules for myself, and I pass them along for your consideration. The notes may be useful to others, or perhaps someone else might suggest improvements on them. Let us suppose that we are going to make a reamer to the dimensions given in the sketch, Fig. 1, and follow through the entire process.

After cutting off and centering, the first operation would be to turn to within about $\frac{1}{4}$ in. of the diameters given, then anneal before finish turning. Annealing takes out the initial stress in the steel and gives you

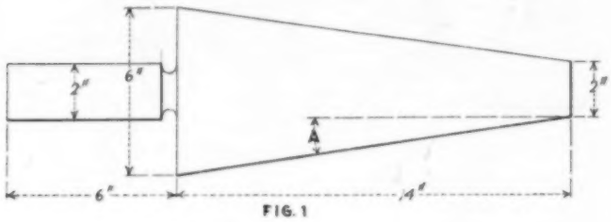


FIG. 1

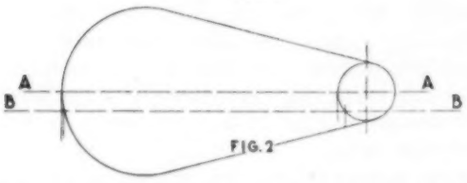


FIG. 2

FIG. 1—SKETCH OF TAPERED REAMER. FIG. 2—WHY THE HEIGHT OF THE TOOL IS IMPORTANT

a better chance to harden the reamer without breaking the teeth. Since the work is such a large solid body with the teeth coming right up to a cutting edge, there is great danger of breaking the teeth in hardening.

Next comes finish turning, leaving about 0.015 in. on the shank and from 0.015 to 0.020 in. on the body for grinding, or a little more according to your facilities for hardening, as the reamer never runs perfectly true after hardening. In turning the taper, it is best to use the taper-turning attachment if you have one. Some taper-turning attachments are graduated in inches per foot taper and some in degrees; if in taper per foot then the calculations would be:

$$\frac{D-d}{L} \times 12 = \frac{6-2}{14} \times 12 = 3\frac{3}{7} \text{ in. per ft. taper,}$$

Where D = large diameter,
d = small diameter, and
L = length of tapered part.

If the attachment is graduated in degrees, the number of degrees would be:

$$\frac{D-d}{2} \div L = \frac{6-2}{2} \div 14 = 0.1428 = \tan A,$$

the angle with the center line.

Tan^{-1} 0.1428 = 8° 10′, which value is as approximately correct as the lathe could be set.

If it is necessary to shift the tailstock center, we must remember that when the piece is revolved the same cut is made on all sides of it, so that when we find the amount of taper, the tailstock must be set over one-half the value. If D equals the large diameter and d the small diameter of the tapered portion, L the total length of the piece and l the length of the tapered portion, then the offset x of the tailstock is determined by the following formula:

$$x = \frac{D-d}{2} \times \frac{L}{l} = \frac{6-2}{2} \times \frac{20}{14} = 2\frac{6}{7} \text{ in.}$$

In the actual turning the tool must be set at exactly the height of the centers of the lathe, and if taken out for sharpening, it must be set back to the same place. If the tool is set either above or below the center, it will take more off the big end of the work, as the sketch in Fig. 2 will show. The large arc represents the big end, the small arc the small end and A the path of the tool on the center line. Now, if the tool be lowered to the line B, it will be nearer to the large circle than the small one at the ends of its travel, hence it would take more off the big end than the small one.

Now that the lathe work is finished, we shall proceed to set up the milling machine. The lead of the helix is 60 in. In setting up for milling a helix, there are two indispensable factors that must first be determined; namely, the pitch of the feed screw and the number of revolutions of the index crank required to turn the work around once. Suppose the feed screw has $\frac{1}{4}$ in. pitch and that it requires 40 revolutions to turn the work around once, the table would advance 40 × $\frac{1}{4}$, or 10 in. per revolution of the work if the lead screw and worm shaft were geared with a 1 to 1 ratio. This value is called the lead of the machine.

From the explanation the following universal rule can be deduced: Multiply the lead in inches to be cut by the number of threads per inch on the lead screw and divide by 40, in order to find the gear ratio needed for the work.

$$\frac{60 \times 4}{40} = \frac{6}{1}, \text{ or a 6:1 ratio.}$$

Thus any set of gear wheels that have a ratio of 6 to 1 can be used whether simple or compound, as the work need turn only one-sixth as fast as it would with the 1 to 1 ratio.

Next let us calculate the proper number of divisions on the index plate for cutting fifty teeth. Since 40 revolutions of the worm shaft give one turn of the work, then one turn of the worm shaft would give $\frac{1}{40}$ turn of the work, suitable for dividing the work into

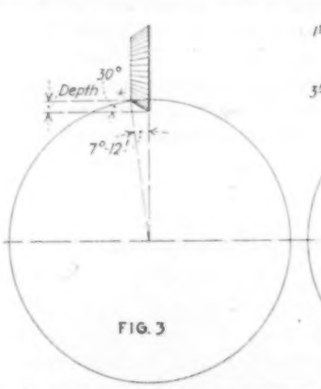


FIG. 3

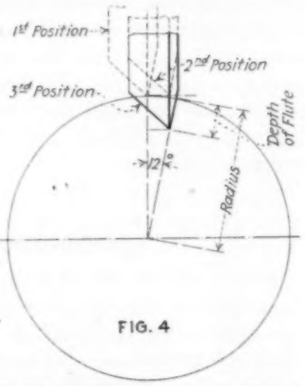


FIG. 4

FIG. 3—DETERMINING DEPTH OF FLUTE. FIG. 4—DETERMINING POSITION OF MILLING CUTTER

40 equal spaces. We can then deduce the following rule: Divide 40, or the number of turns required for one turn of the work, by the number of divisions into which the work is to be divided, and the resulting fraction will give the number of turns or part turns which the index crank must make to obtain the desired

result. Thus, $\frac{40}{50} = \frac{4}{5}$ of a revolution, which can be obtained on any convenient circle of holes in the plate.

Next we must move the table around so that the line of the cut will be as nearly as possible in line with the milling cutter. This angle is found by dividing the circumference, taken at the center in a taper reamer, by the pitch of the helix, which result will be equal to the tangent of the angle. The diameter at the center of the reamer is 4 in.; the formula therefore would be

$$\frac{4 \times 3.1416}{60} = 0.209 = \tan B$$

$B = 12$ deg., nearly, angle at which to set table.

Now it is evident, since this is a taper job, that one center must be higher than the other. Also, it is imperative that the centers should be in line with each other, that is, pointing directly toward each other. If not, the teeth would not be equally spaced, and we should have wide lands on some teeth and no lands at all on others. Also, the cut must be deeper at the big end than it is at the small end in order to leave the lands parallel. This being the case, we shall work out the depth of cut and get the angle and height of the centers.

The depth of the cut can be found as follows: Dividing 360 by the number of cuts gives us the angle at the center, as shown in Fig. 3. Thus, $360 \div 50 =$ 7 deg. 12 min. center angle. Multiplying the tangent of the angle by the radius gives the width of the cut.

If we are using a 60-deg. cutter, the tangent of the opposite angle, or 30 deg., multiplied by the width will equal the depth. The depth then will be tan 7 deg. 12 min. multiplied by the radius, multiplied by tan 30 deg. At the large end the depth is, $0.126 \times 3 \times 0.577 = 0.218$ inches.

If we set the machine at the correct angle we need not consider the depth at the small end, as it will automatically adjust itself. The depth of the cut at the large end will be 0.218 in. If this cut were continued until it ran out to nothing, it would run out at the point where the surface of the cone and the center line would meet. The length of this center line can be found by simple proportion, thus: If the center line is 14 in. long in a 2-in. taper, how long will it be in a 3-in. taper?

$$2:14 = 3:x \qquad x = \frac{14 \times 3}{2} = 21 \text{ inches.}$$

Or, by using the previous calculations which we made for lathe work, the side opposite, that is 3 in., divided by the tangent of 8 deg. 10 min., equals the length of the center line, or 21 in. Now, by deducting the depth 0.218 in. from the radius 3 in., we can obtain our angle for the centers.

$$3 - 0.218 = 2.782 \text{ in.}$$

$$\frac{2.782}{21} = 0.132 = \tan 7 \text{ deg. } 30 \text{ min., approximately.}$$

The angle between the centers is thus about 7 deg. 30 min. There is still a chance for a serious error, as the tail center may not be at the right height. The difference in height from the table would be the tangent of 7 deg. 30 min. multiplied by the length of the work or the distance apart of the centers.

$$0.132 \times 20 = 2.640 \text{ in.}$$

This calculation neglects the depth of the center holes. If extreme accuracy is required, the depth of the center holes must be allowed for.

After adjusting the machine to these requirements, set the sharp point of the cutter exactly over the point of the center. We are using a 60-deg. cutter with angles of 48 deg. on one side and 12 deg. on the other, as this is found by practice to give the best results. Lower the table and place the work between the centers, start up the machine and raise the table until the cutter just touches the work at the large end. Now the work must be pushed over to one side and raised until the edge of the cutter which forms the cutting angle coincides with a radius of the work when the cutter is at the required depth. This position can be found as follows:

Referring to Fig. 4, the first position has already been set by placing the edge of the cutter over the center. For the second position, since the edge of the cutter makes an angle of 12 deg. with the center line, the side movement of the work will equal the radius minus the tooth depth, multiplied by sin 12 deg. The figures are: $(3 - 0.218) \times 0.2079 = 0.5784$ in. movement.

The depth of the tool from the center line, or the amount to raise the table can be obtained as follows: The radius minus the depth, times the cos 12 deg. gives the height of the cutter point above the center line. The distance to raise the table can be easily found. Thus,

$(3 - 0.218) \times 0.9782 = 2.722$ in. from center line to cutter.

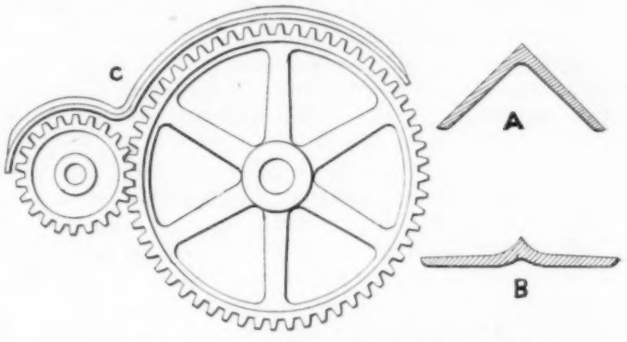
$3 - 2.722 = 0.278$ in. to raise table.

No other calculations are necessary, and we can go ahead with a reasonable certainty of making a good job. This may not be the best method, but it is the way the problem appears to me. If any of my fellow readers have different methods, let us have them, as the exchange of ideas is mutually profitable.

A Novel Method of Making a Gear Guard

By Frank C. Hudson

A very interesting method of making a guard for the gears in large hoisting machinery has been devised by the Vulcan Iron Works, Denver, Colo. The plan consists of taking an angle of the proper dimensions, as



GEAR GUARD MADE FROM STEEL ANGLE

shown at *A* in the accompanying illustration, and rolling it, as at *B*, which spreads out the two legs and leaves the corner to form a substantial web or backbone that adds materially both to the appearance and stiffness of the guard.

The flattened guard is then shaped to fit the gears it covers, as shown at *C*, while the backbone is tapered down at the ends both for the sake of appearance and to make the ends free from propections of any kind.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

July 12, 1923

Commercial Arbitration Becoming Popular

THE INTERESTING experiment in commercial arbitration instituted by the Arbitration Society of America seems to be working out well. We learn from a recent issue of the organ of the Merchants' Association of New York that results of a questionnaire sent to the members of the association showed 806 out of 810 favorable to arbitration. Not only that, each of the 806 pledged himself to adopt the practice of submitting commercial controversies to arbitration as soon as adequate arbitration machinery is available.

The arbitration movement is one of the most promising that has come to our notice in recent years. At last the congestion of our law courts is to be taken out of the class of Mark Twain's weather of which everybody complained but about which nobody did anything.

Just how serious the situation has become in the New York courts is indicated by the fact that there are now some twenty-four thousand cases on the calendar of which something less than nine thousand can be settled in a year. New ones are added at the rate of thirteen thousand per year.

In most cases the commercial dispute rests on interpretation of facts and can be as justly settled by an impartial arbitrator in a more or less informal and inexpensive way than by a court with all of its formality and delay. If arbitration will clear the court dockets of even a third of the pending cases it will be an unmixed blessing to the community and will save a lot of money.

As to the parties in a commercial dispute the savings to them in time and expense are remarkable. Lawyer's and witness' fees may be dispensed with and a case may be settled by the arbitrator in a few hours instead of as many weeks. With courts congested as are those of New York the best case in the world may be lost if it does not come to trial for three years. The witnesses may die or get out of reach and the keenest memory for facts loses its edge after such a lapse of time.

Some indication of the wide interest in arbitration as a substitute for litigation may be had from a communication from the Court of Arbitration of the International Chamber of Commerce to the Merchants' Association. In that letter a model paragraph, much the same in substance as the pledge taken by the Association members in their questionnaire, is suggested for insertion in the margin of any business letter head.

Perhaps if arbitration gets to be established internationally as the best means of settling commercial or contractural difficulties it may be possible to convince statesmen that armies are too expensive for settlements of squabbles between nations.

Study Your Gaging Methods

THERE seems to be lack of appreciation in some quarters as to the way in which the method of gaging affects the cost of the product. First of all comes the determining of the amount of interchangeability which is either necessary or desirable. This depends largely on the quantity to be manufactured and the frequency with which parts have to be replaced. From the point of view of production cost, it is necessary to determine whether it is cheaper to do a little fitting, to have selective assembly without fitting, or to stick to strictly interchangeable manufacturing within the necessary limits.

There are many cases where needless expense is incurred for gages in the attempt to secure unnecessary accuracy on parts which are never replaced. For while it insures easy assembly, the cost is frequently out of proportion to the benefits derived. Experienced engineers have come to the conclusion that unit interchangeability should be used in more instances than seems to be the case. This means that the units which go to make up the complete machine, should fit together, as units, but that all the individual parts which go to make up the unit need not be interchangeable, but can be put together by selective assembly, or even fitted.

Closely allied with the question of gages is the setting of tolerances. Here, too, the experienced engineer is of great value in determining what tolerances will be satisfactory and yet not be so close as to increase the cost of production, and add to the percentage of scrap.

Then there is the cost of gages themselves, some types being more expensive than others. The choice of methods also affects this expense and here is where the unilateral gaging system is particularly useful. With the bilateral system, or the "plus and minus" method, both maximum and minimum or go and no-go gages have to be special. But with the unilateral system a standard plug gage is the "go" gage for the hole and a standard ring gage the "go" gage for the shaft. And standard gages are always less expensive than when they have to be made special. The "no go" gage must of course, be special in either system.

Careful attention to tolerances and gaging methods will help to reduce the indirect production costs more than many seem to realize.

Endangering the Morale of Technical Government Employees

THE MUCH discussed dismissal of the experienced engineer at the head of the Reclamation Service by the new Secretary of the Interior is likely to have at least one bad result. Other underpaid technical men in the Bureaus of Standards and of Mines, and in the Coast and Geodetic Survey are sure to wonder about the security of their positions when a man with the long service of Mr. Davis can be thrown out on two weeks' notice. They can hardly be blamed for lending a more attentive ear to offers of higher pay from private industry. And if they begin to drift away from the national technical services it will be impossible to replace them. We hope that Secretary Work's action is not to be taken as establishing a precedent.

Shop Equipment News

Peerless 13-Inch Universal Shaping Saw

The Peerless Machine Co., Racine, Wis., has just announced a sawing machine with 13x13-in. capacity, similar to the universal shaping saw which was announced in the *American Machinist* on page 386, Vol. 56.

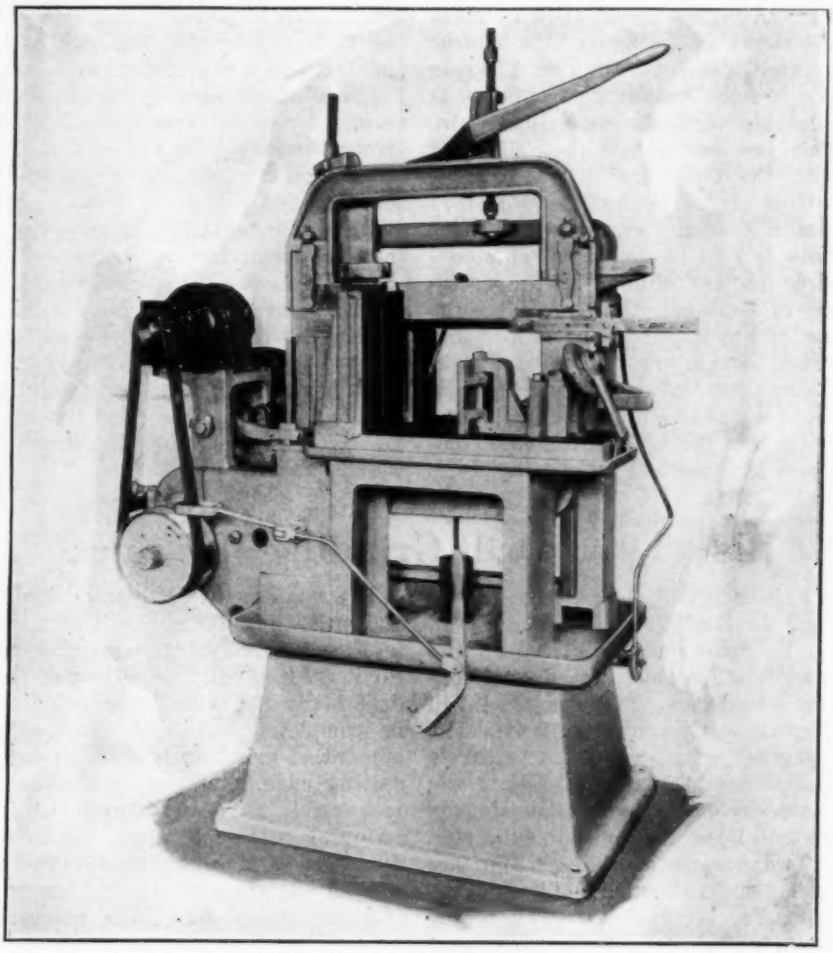
The frame accommodates blades from 14 to 21 in. in length and as in the smaller machine the blade clamping apparatus is designed to permit putting up to 10,000 lb. tension on the blade. In addition, a so-called saw blade thrust plate has been added. This plate is shown above the blade in the illustration. The purpose of it is to take care of the upward thrust so as to hold the blade tooth points in a straight line. Tests indicate that blades of 1 in. and even ¾ in. width can be used safely.

The thrust plate is 4 in. wide, 30 in. long and 0.048 in. thick, or corresponding closely to 18-gage saw blade stock. It is made of saw blade steel and receives tension through the use of two clamping straps. In addition, two set screws permit fine vertical adjustment so as to bring the thrust plate down to the blade for careful alignment.

An improvement designed to cut down handling time is the dual control feed mechanism. The operator throws the feed lever on either side of the machine with one hand while the other hand is used to bring down the saw blade and frame to approximately cutting position just prior to engaging the feed. In the illustration it will be seen that the belt shifting gear is connected to the starting lever so that one straight line forward motion shifts the belt onto the tight pulley thereby putting the saw frame in motion and also engaging the feed, so that the cut is started.

The dual control apparatus also saves time when the operator wants to stop the machine just after it has marked the cut, to see how near the line the cut is going to be. Sometimes the length of the work is on the right hand side of the blade and again it is on the left side.

A stop rod for automatically stopping the saw at the completion of the cut or at a pre-determined depth is also part of the saw frame mechanism. The rod is made telescopic in action by use of a tubular member. In addition, knurled depth and height gages are found on the screw located above the saw frame. Thus instead of letting the large coil spring lift the saw frame up to its extreme height upon completion of a cut, the height gage is brought down sufficiently to permit the blade to rise just enough to clear the work.



PEERLESS UNIVERSAL SHAPING SAW

The vise table is the upper part of the bed that is bolted to the base of the machine and stands 42 in. from the floor. An angle plate held in place with two large bolts makes up the front vise jaw. The rear jaw is brought forward by means of a screw and shoe arrangement. The screw accommodates fine adjustment with a total travel of 2 in. For approximate or coarse adjustment two nuts are loosened in the shoe permitting the heads of the two bolts to drop and be drawn back or forward with the shoe. The two T-slots in the vise table proper are made so that standard ¾-in. bolts can be used and alignment secured from the finished walls of the slots without the bolts injuring the walls. In addition, the two cored T-slots are provided with angular teeth similar to a ratchet rack which receive the heads of the bolts in the shoe. These cored ratchet teeth take the thrust of the two bolts in the shoe and space off the coarse rear jaw adjustments.

The height of the front jaw is 15

in. An auxiliary front jaw or angle plate is located on the other side of the saw blade to align the work being cut off and the width of this jaw is 10 in. Thus a piece of work 20 in. in length is balanced on the vise table. The total over-all width of the vise table from the loading side to the outboard bearing side is 18 in. In the outboard bearing two T-slots similar to those described above are provided for clamping the work when desirable.

For angular cutting it is simply necessary to remove the auxiliary angle plate and swing the front jaw around to any angle up to 45 deg. The capacity on a 45-deg. angle is 9 in. Attention is called to a square key shown in the figure that insures square alignment of the vise. The rear jaw is made so that its front face is rotatable vertically on a hinge pin. This jaw has a heel that aligns it with the front jaw when straight cutting is done but that swings around when angular or taper work is held in the vise. This construction has eliminated the necessity of a sub-base thus combining the use of angle plate, vise proper and swivel vise in one. A refinement in the nature of a water trough around the vise and two pipes that guide the water into the tank in the base completes the vise and table.

The rear of the machine has the same appearance as the 6-in. shaping saw, being equipped with a three-speed sliding transmission that will provide stroke speeds of 125, 80 and 45 strokes per minute. The speeds are intended for the three general classes of steels, i.e., mild steels, alloy steels and tool steels.

The motor bracket is an integral part of every machine and is designed to receive motors of 1 to 1½ hp. In belt drive the belt is simply run down from the lineshaft to tight and loose pulleys.

In the front of the machine the usual feed adjusting hand wheel is found. Any pressure from zero to 200 lb. can be applied vertically to the blade. The blade travels back and forth in a horizontal plane.

The lubricant pipe can be adjusted to any direction through the clamp shown in view. The pump is of the centrifugal type and runs at constant speed.

To eliminate the friction set up through the lifting spring that holds the whole unit in suspension and to insure accurate lifting of the unit on each return stroke, roller bearings are provided in four joints.

General specifications are: Height, 7 ft.; width, 2 ft. 7 in.; length, 6 ft. 3 in.; weight, net 2,200 lb., shipping weight about 2,400 pounds.

Blau Twist Drill Grinding Machines

Friedrich Neumann's Successors, Inc., 42 East 20th St., New York, N. Y., have recently placed on the market a line of twist drill grinding machines manufactured in Vienna, Austria, by Blau & Co. The machines give quick and accurate sharpening of twist drill points and enable grinding the drill uniformly on both lips to predetermined angles.

Two models of the machine are made, one for small drills and the other for larger ones. The reason for this division is partly because of the fact that a simpler machine can be used for small drills, and also because a plant usually has a large number of small drills that require frequent sharpening. The small machine is for use on drills from No. 38 to ¾-in. in diameter, while the larger one is for drills from ¾ to 2-in. in diameter. In a plant equipped with both machines the grinding of large and small drills can thus be carried on independently, and it is not necessary to hold any drills in the hand while sharpening.

The small model of the machine is known as the SPL, and is illustrated in Fig. 1. The advantages claimed for it are that only one setting of the drill is required until the grinding is complete, and that the same amount of grinding is done on each cutting edge, that the lip clearance is variable as desired, and that a swinging motion is given the gripping head so as to produce a correctly ground surface.

A cup-shaped base plate mounted on a pedestal carries the mechanism of the machine. The countershaft at the back of the table is driven from the overhead lineshaft and, in turn, drives the spindle carrying the wheel. The drill to be ground is held between the jaws of the chuck at the front of the machine, which jaws are tightened by the star wheel on the body of the chuck. The shank end of the drill is centered and backed up by the retainer shaft in the end of the chuck. After setting, the retainer is locked in position.

The head carrying the drill is mounted on a swinging arm and counterweighted. With his right hand the operator swings the head. The motion is such as to produce a surface that is part of the surface of a cylinder. By means of the lever shown at the side of the machine, the drill-holding head is fed toward the wheel. A screw stop is provided to limit the motion of the lever, which stop is then set after the point has been ground sufficiently. By means of an indexing device in the chuck, the drill is then swung through 180 deg. without changing any other adjustment. The second lip can then be ground. Thus, both lips have exactly the same form and angle. It is stated that the entire grinding operation can ordinarily be accomplished in about one minute.

A collar on the gripping head has a scale marked for different sizes of

FIG. 1—BLAU SMALL TWIST DRILL GRINDING MACHINE

drills. The lip clearance is controlled by means of this scale, and is automatically adjusted to the desired amount by merely swinging the collar. By setting for a larger drill than the one in the chuck a greater clearance than normal can be obtained. Smaller clearances are obtained by setting the collar for smaller drill sizes. The machine requires ¼ hp., has a floor space 2 ft. square and weighs 180 pounds.

The larger machine is designated as the model SPK. As can be seen in Fig. 2, it is considerably larger

and more complicated than the small machine, partly because it contains some automatic motions. The drive shaft carrying tight and loose pulleys is mounted at the bottom of the base. A separate motor for individual drive may be placed on an extension of the base.

Near the top of the pedestal the grinding spindle, driven by belt from below, is mounted. At one end it carries an annular wheel for grinding the drill, and at the opposite end a small grinding wheel for thinning the point of the drill. The large grinding wheel is encased, except at the portion where grinding takes place, so that the water is not thrown from the machine. A pump and water circulating system are provided.

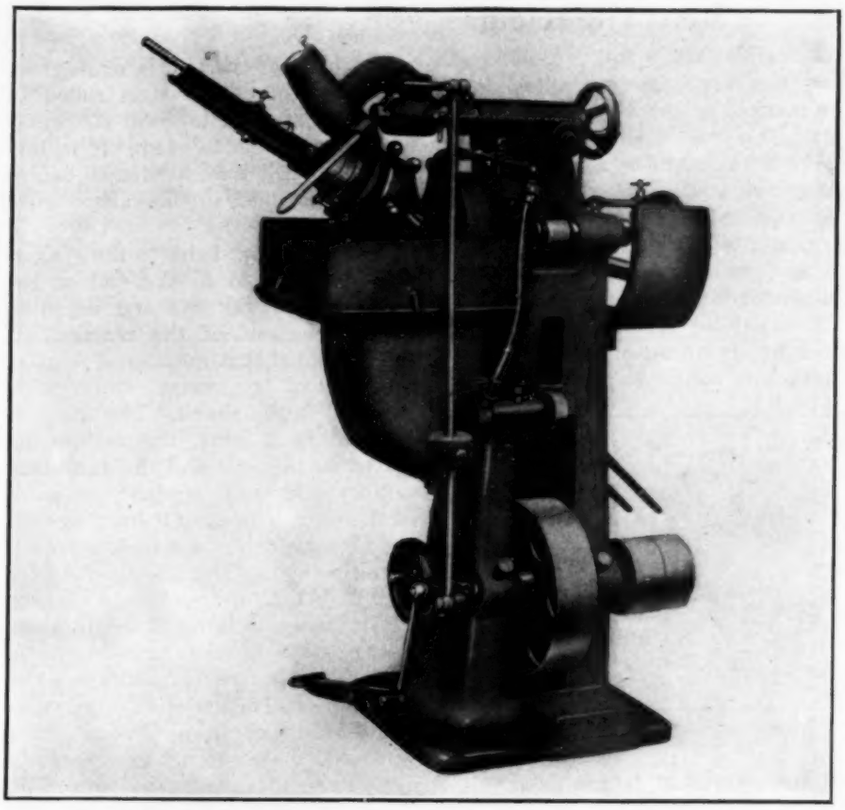


FIG. 2—BLAU LARGE TWIST DRILL GRINDING MACHINE

The drill is held in a chuck or gripping head similar to that used on the small machines. The front end of the drill is gripped by jaws fitting each land near the cutting edge. The shank end is centered by means of a reversible cup-shaped retainer. The lip ground on the large machine is different from that on the small one, in that each ground surface lies in the surface of a cone and is produced by two motions on the machine.

The whole head swings about the horizontal shaft at the top of the column, so that the drill point is moved across the wheel and causes it to wear down uniformly. The head is connected to a pedal mechanism, so that when the pedal is depressed the head is caused to oscillate back and forth automatically. The drive for this motion is taken from the main drive shaft at the bottom of the machine.

The head can also be oscillated about a shaft mounted on the swinging arm, which shaft really is the axis of the grinding cone. This motion is produced by one hand of the operator acting on the handle mounted on the side of the head. The mounting of the head is such that the distance between the axis of the drill and that of the grinding cone can be varied, so as to suit the size of the drill and the point desired.

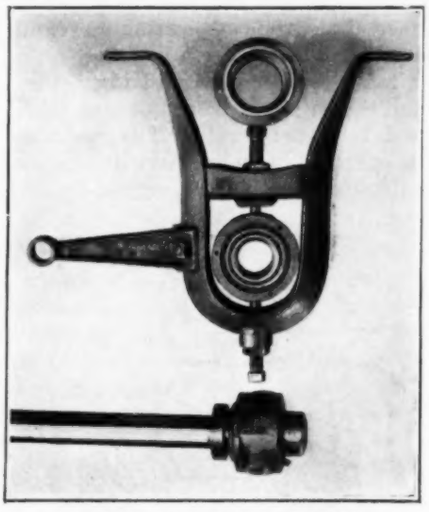
A scale is provided for adjusting this distance, which scale reads directly in diameter of drill. A normal lip clearance can be produced by setting the scale to the size of the drill to be ground, while either larger or smaller lip clearances can be obtained by setting for either larger or smaller sizes of drills than the one being ground. After one lip has been ground, the gripping head is simply indexed through 180 deg. and the other lip ground to give an exact duplicate of the first grinding.

The machine is equipped with a point thinning feature. After the lips have been ground, the drill is laid in the support at the end of the machine carrying the small wheel. It is then raised by means of a screw until a sufficient amount has been ground from the point. After one side has been ground, the stop limit is set, the drill is turned over and a like amount ground from the other side of it. In this way, a freer cutting drill requiring much less feed pressure is obtained. The large machine requires ¾-hp. to drive it, has a floor space 4 ft. square and weighs 750 pounds.

St. Louis Roller Bearing Countershaft Box

The St. Louis Machine Tool Co., St. Louis, Mo., is now marketing a roller bearing countershaft box which has been developed for use with its own products. The arrangement of the parts of the device is shown in the accompanying illustration.

The box is fitted with an adjustable taper roller bearing, of proper size for the service required, and has suitable sockets so that it will fit in standard hangers. The back of the box is solid, the front has the usual style of end plate, and both front and back are fitted with felt washers and retainers. Necessary collars for the shaft accompany the box.



ST. LOUIS ROLLER BEARING COUNTERSHAFT BOX

These boxes can be put into old hangers without taking them down. They can also be furnished complete with pressed steel hangers.

Geometric Milling Tool

A tool that will drill, face and mill the six sides of a hexagon has been developed by the Geometric Milling Tool Co., 108 N. Jefferson St., Chicago, Ill. The tool, which is shown in Fig. 1, consists of a case in which are three spindles, carrying three tools. The three spindles are located in the bottom plate, each spindle carrying a gear meshing with a gear on a central shaft, and also with an internal gear cut on the inside of the case. The central shaft has a taper shank to fit into the spindle of the machine. When the central shaft is revolved, the three cutters revolve and also rotate on a fixed circle, thus generating a cycloid curve as illustrated in Fig. 2.

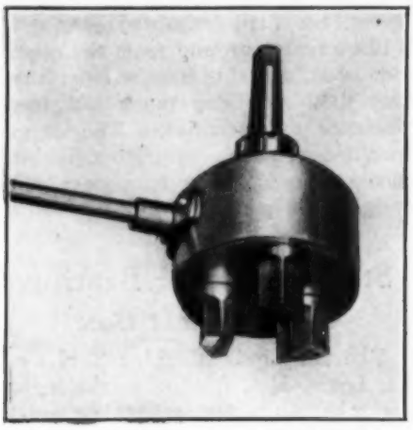


FIG. 1—GEOMETRIC MILLING TOOL

Each tool has two cutting edges, and the cutters are both demountable and interchangeable. The tool can be operated in an ordinary drill press in conjunction with a simple fixture to hold the work and guide the body of the tool. While the tools are in operation, the body is held stationary by means of an arm which allows the tool to move vertically, but prevents the body from rotating. The tool produces a slight curve in the sides of the hexagon, but the curve is so slight that it should not be objectionable for practical purposes.

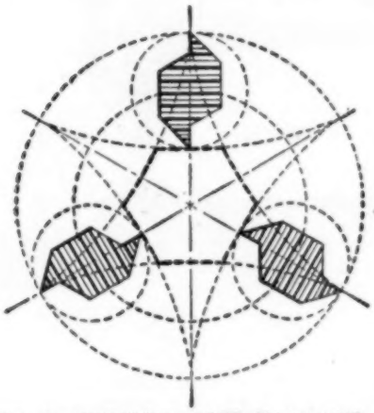


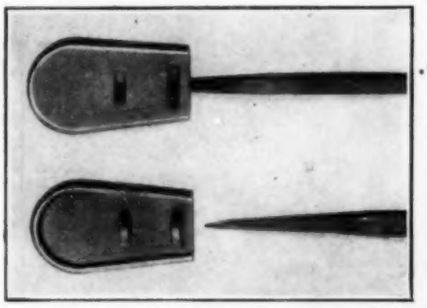
FIG. 2—SHOWING HOW HEXAGON IS GENERATED

The tool is sturdily built, of good materials, and is bronze bushed throughout. The tool is regularly made to mill hexagons on valves and fittings of ⅜, ½, ¾, 1 and 1¼ in. pipe sizes, but can be equipped with special cutters to conform to any manufacturer's standard.

Nestor Metal File Handle

A metal handle for use on small files has recently been placed on the market by the Nestor Manufacturing Co., 40 West 13th St., New York, N. Y. At the top of the accompanying illustration is shown the upper surface of the handle with a file fitted to it, while the lower view in the illustration shows the under side of the handle.

The handle is made from sheet steel by stamping operations. The edges are rolled to give a smooth surface, and two straps are formed for holding the tang of the file. The device is nickel-plated to prevent rusting.



NESTOR METAL FILE HANDLE

The handle is 1⅛ in. broad and 1⅞ in. long and is suitable for practically all types of files up to 8 in. in length. It can be readily attached and detached, and provides a strong grip on the file. The gripping portions are not likely to be enlarged with use, as in the case of wooden handles, so that a grip on the tang is no longer afforded.

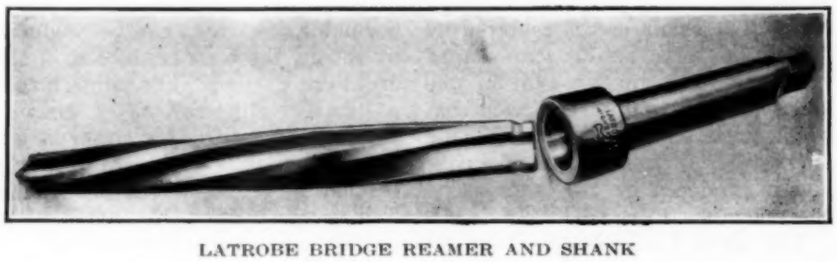
Latrobe High Speed Bridge Reamers

A line of high speed bridge and boiler reamers is now being manufactured by the Latrobe Tool Company, Latrobe, Pa. The reamers are made in both five flute straight and four flute spiral types, either of which can be furnished in bridge reamer or short car reamer length. The points are ground sharp with a chamfered cutting edge on each flute, to enable the tool to enter burned holes or holes that are not matched.

The body of the tool is made from a bar of high speed steel rolled to the proper profile to form the flutes when the bar it twisted. It is machine finished and hardened before being assembled in the carbon steel shank.

To attach the shank to the reamer a hole is drilled in the end of the shank the proper size and depth to receive the end of the reamer. It will be noted that notches are cut in the body of the reamer where it is inserted in the shank. The shank is chucked in a lathe, the reamer inserted in the hole and the tail stock center is brought against the point of the reamer to keep it hard against the bottom of the hole and to hold it in alignment. The lathe is started at a high rate of speed and two spinning tools are brought against opposite sides of the large diameter of the shank right over the joint to be made. The friction heats the shank red hot in a few moments, and soon makes it hot enough to be plastic, so that it can be formed by pressure.

As soon as the shank metal is hot enough to work more pressure is applied to the spinning tools while the work is still rotating at high speed. The outside diameter is reduced and the metal of the shank flows around the reamer body and keys in the notches and flutes shown. Shrinking of the shank from its higher temperature makes the joint tight, and only finish grinding is required to complete the tool.

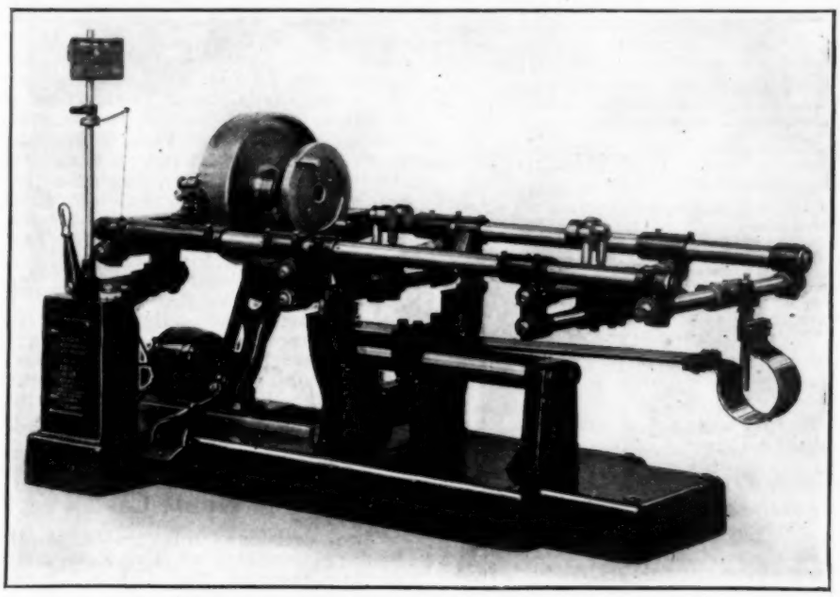


LATROBE BRIDGE REAMER AND SHANK

Gisholt "Precision" Balancing Machine

The Gisholt Machine Co., 9 So. Baldwin St., Madison, Wis., has recently placed on the market the "Precision" balancing machine that is herewith illustrated. The machine applies the principles of dynamic and static balancing invented by Dr. B. L. Newkirk and is similar to the "Precision" balancing machine described on page 653, Vol. 56 of the *American Machinist*. It is adapted to a wide variety of work, such as crankshafts, flywheels, rotors, pulleys, and other revolving parts. It will receive bodies up to 24-in. in swing and 32-in. between bearings.

It is possible to obtain complete dynamic and static balancing by means of two corrections that are individually measured near the ends of the body. When a number of duplicate parts are to be balanced in production, great rapidity can be obtained. In such circumstances, it is not necessary to make the test for static balancing, and the operator need perform only a few simple steps.



GISHOLT "PRECISION" BALANCING MACHINE

A spring-mounted and pivoted frame carries a special type of head stock and adjustable rollers to support the work. The form and location of the springs are such that a free vertical vibration of the frame may take place about the pivot springs as a fulcrum point. All revolving parts, including the rollers which support the work, are mounted on ball bearings.

In making a test, a speed of rotation above the "critical speed" of the frame is first used, and the driving power is then disengaged, permitting a gradual diminution of speed down to and through the free critical speed of the frame. From the observation on the dial indicator, mounted part way up on the column at the left, the amount of correction required is determined.

A disk at the left of the revolving parts carries a standardized 10-oz. weight, adjustable radially by means of a vernier to 0.01 inch. These parts are exactly balanced when the weight is at zero. The disk is adjustable to any angle by reference to a protractor dial. The weight can thus be moved to counterbalance the work.

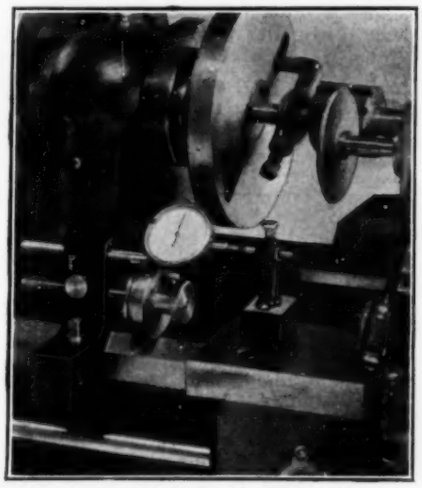
With the correction thus arbitrarily applied, the machine is again speeded up and allowed to pass through the critical speed as before. The second amplitude in this process bears a relation to the first amplitude dependent on the angle between the point of application and the point required. After determining and setting off this angle, a third run will check the result. For determining the corrections proportionate to amplitudes, and ascertaining angles, a special calculating rule requiring but two settings is situated at the top of the instrument column.

After completing the first determination, the work is reversed in position and the correction determined for the plane initially over the pivots, thus completing the operation. A critical speed of about 100 to 110 r.p.m. is generally employed.

Frick Spacing Indicator

The Frick spacing indicator, shown attached to a lathe in the illustration, has just been introduced by the Precision & Thread Grinder Mfg. Co., Philadelphia, Pa. This instrument was developed for accurately spacing the teeth of no-pitch hobs during grinding and is also of use for accurate spacing of shoulders in counterboring operations, where it is ordinarily impossible to measure the depth accurately.

The indicator consists of a cast iron base, adapted to be clamped on the ways of a lathe, carrying a fine-pitch screw and a sliding rod. By means of a clamp, both rod and screw may be held at a given setting. At the end of the screw is mounted a micrometer dial, graduated to tenths of thousandths of an inch which may be used to rotate the screw or, by loosening a thumbscrew, may turn freely upon it. The sliding rod carries a dial indicator at its outer end and is moved in and out by the micrometer dial on the screw. A stop pin, mounted on the lathe carriage, is arranged to depress the indicator plunger as the carriage is moved.



FRICK SPACING INDICATOR

With the stop pin against the indicator plunger, screw and rod clamped, and the micrometer dial loose on the screw, the indicator and the micrometer dial are both set at zero. The dial is then fastened to the screw and the required spacing is set by means of the dial, after unclamping the screw and rod. The lathe carriage is then moved until the indicator reads zero. For the next space the dial is again set at zero and the preceding operations are repeated. Rapid work is thus possible.

News Section

Steel Men Are Promised Eight-Hour Day

Announcement was made by President Harding on his arrival in Tacoma recently that the American Iron and Steel Institute had given provisional assent to his effort to obtain the abolition of the twelve-hour day in the steel industry.

The announcement took the form of making public a letter to the President from the Directors of the institute, headed by Judge Elbert H. Gary, President of the Board of Directors of the United States Steel Corp.

This letter was in response to a request by the President that the Iron and Steel Institute give him a pledge that as soon as conditions of employment warranted the employers of labor concerned would return to the eight-hour day for most workmen and to the ten-hour day for others. The pledge is contained in the letter made public in behalf of President Harding today.

The history of the announcement dates back to the meeting of the Iron and Steel Institute in the Spring, when a committee, of which Judge Gary was Chairman, reported that it was not feasible to abolish the twelve-hour day in steel plants. Various reasons were given for his conclusion, the chief of which was that the scarcity of labor, due to the restrictions placed on immigration, made it impossible for steel manufacturers to put the eight-hour day into effect.

The President's Attitude

President Harding at that time expressed his keen disappointment over the action of the Iron and Steel Institute. In connection with the letter made public today it was explained that on June 18 the President asked the institute to give him a pledge that it would abolish the twelve-hour day when conditions of labor warranted that course.

The letter from the Directors of the institute reads:

New York, June 27, 1923.

To the Honorable Warren G. Harding, President of the United States:

Dear Mr. President—Careful consideration has been given to your letter of June 18 by the undersigned Directors of the American Iron and Steel Institute, comprising all of those whose attendance could be secured at this time.

Undoubtedly there is a strong sentiment throughout the country in favor of eliminating the twelve-hour day, and this we do not underestimate. On account of this sentiment, and especially because it is in accordance with your own expressed views, we are determined to exert every effort at our command to secure in the iron and steel industry of this country a total abolition of the twelve-hour day at the earliest time practicable. This means the employment of large numbers of workmen on an eight-hour basis and all others on a basis of ten hours or less without an unjustifiable interruption to operations.

The change cannot be effected overnight. It will involve many adjustments, some of them complicated and difficult, but we think it can be brought about without undue delay when, as you state it, "there is a surplus of labor available."

Machinery Exports Still Increasing

Exports of metal-working machinery during May, 1923, with revised comparative figures for May, 1922, as compiled from the returns to the Department of Commerce, were as follows:

	May, 1922 Value	May, 1923 Value
Lathes	$66,604	$57,138
Boring and drilling machines	71,065	42,106
Planers, shapers and slotters	17,590	17,256
Bending and power presses	15,771	27,038
Gear cutters	6,174	17,787
Milling machines	25,255	24,914
Thread cutting and screw mach.	17,668	71,476
Punching and shearing machines	12,610	14,167
Power hammers	13,146	8,150
Rolling machines	16,270	3,000
Sharpening and grinding machines	83,304	112,779
Chucks, centering, lathe, drill and other	24,387	27,080
Reamers, cutters, drills and other parts for machine tools	113,696	200,037
Pneumatic portable tools	18,930	55,565
Foundry and molding machinery	75,887	13,085
Other metal-working machinery and parts of	313,721	398,765
Total metal-working machinery	$892,078	$1,090,343

Similar figures covering motor car exports follow:

	May, 1922 Value	May, 1923 Value
Automobiles & chassis (Total)	$5,763,539	$9,795,725
Motor trucks and busses except electric	812,170	1,236,416
Passenger cars, except electric	4,924,134	8,534,265

Considering Standards For Gas Pipe

The American Gas Association has submitted for the approval of the American Engineering Standards Committee three specifications for cast iron pipe and special castings.

These specifications were developed by the American Gas Institute in 1911, at which time the dimensions for bell and spigot castings were adopted. In 1913 the Association adopted the dimensions for flanged castings, and specifications governing the manufacture of all cast-iron pipe and specials, which were derived from an old standard adopted in 1905 by the American Gas Light Association. These again were based on seven years' experience with the standards designed by the Society of Gas Lighting in 1890. It is said that the specifications now under consideration are in general use for underground gas pipes throughout the United States.

The A.E.S.C. has appointed a large and thoroughly representative special committee to consider the application for the approval of these specifications, and sponsorship for future revisions under the regular procedure involving the organization of a representative sectional committee to consider and develop any changes required. The following are the members of this special committee:

S. G. Flagg, Jr., chairman, representative of the American Society of Mechanical Engineers on A.E.S.C.; F. A. Barbour, representing the American Water Works Association; E. A. Barrier, representative of the Fire Protection Group on A.E.S.C.; W. Forstall, representing the American Gas Association; A. H. Hall, representative of the gas group on the A.E.S.C., and representing the American Gas Associaton; W. G. Hammerstrom, chief engineer, the Lynchburg Foundry Co., Lynchburg, Va.; H. Kely, representing the Associated General Contractors of America; N. F. S. Russell, representing the U. S. Cast Iron Pipe & Foundry Co.; R. Toensfelt, representing the American Society for Municipal Improvements; W. Wood, president, R. D. Wood & Co.; C. D. Young, representative of the American Society for Testing Materials on the A.E.S.C.; F. A. McInnes, representing the New England Water Works Association; F. F. Schauer, representing the Natural Gas Association of America; A. W. Claussen, representing the Underwriters' Laboratories, and J. C. Meloon, representing the National Automatic Sprinkler Association.

Spirited Litigation in New Home Case

Two decisions unfavorable to the banking creditors of the New Home Sewing Machine Co., Orange, Mass., were given July 3 by Judge Anderson of the United States District Court. By one decision the receiver, Charles N. Stoddard, is given free use of assets comprised in bills receivable, amounting to $655,160, inclusive of $180,000 cash already collected. In another decision on an issue raised by banks seeking to intervene as parties to the litigation, the judge denies the petitioners' right to intervene. He finds that attorneys representing a group claiming to be a banking creditors' committee filed early in the proceedings a petition asking leave for the banks to intervene and that this petition was granted. In their recent petition the banks assert the previous petitioners acted without authority, to which the court replies that "in effect this is a charge of fraud upon the petitioners and upon this court." The judge decided that proof of such fraud should be sought, if at all, through separate court inquiry.

Railroads in Cincinnati Markets

The Cincinnati machine tool market has been stimulated during the past two weeks by the volume of business placed by railroads. In a period when the usual Summer lull has been felt to some extent, the railroads have been placing good orders with local concerns. In several instances Eastern railroads, that have previously confined their purchases to the highest grade machinery, sent in orders for cheaper grade machines. The machine tool manufacturers report that the Western railroads are showing no inclination to purchase any tools or machinery except that of the highest quality. The Denver & Rio Grande R.R. was one of the largest buyers in the local market during the past ten days. The LeBlond Machine Tool Co. closed a big order with this railroad for shop tools.

Electrical manufacturers have also been in the Cincinnati market lately placing generous orders with machine tool houses in this city. The Westinghouse Electric & Manufacturing Co. and the General Electric Co. have been active in placing orders for tools and radial drills.

Public utilities are not in the market at present and are holding off making any purchases except those that are absolutely essential. One large company states that it is doing considerable business with the oil industry.

Many Inquiries

Inquiries for machine tools seem to be rather plentiful, but they are not developing into immediate business. Taking into consideration the usual falling off in the volume of business at this time of the year, orders have been fairly good and are ahead of the total for the same period in 1922. Most of the machine tool manufacturers believe that the outlook is for a continuation of present conditions during July and possibly August with a revival of activities on a larger scale in September. Some houses report, however, that they have sufficient orders now on hand to run their plants through the Summer months. Deliveries are not as rapid as desired, partly because material is hard to obtain and also because shipments on the railroads are somewhat slow.

Orders from automobile manufacturers have decreased lately to a marked extent and it is not expected that there will be many large purchases of machine tools by this industry until Fall. Electrical tool houses state that their orders have been holding up well and that their manufacturing schedule calls for a fair amount of production in the next month.

Milling machines are not in such great demand at present while orders for lathes have also shown a decrease, although manufacturers feel that both orders and actual production are satisfactory for this time of the year. Firms making planers state that orders are good and their business is much better than last year.

Those concerns that deal in used machinery report that business has not slackened throughout June and the beginning of July. Their books show that sales throughout the first six months of 1923 are 100 per cent better than in 1922 for the same period. Public utilities are in the used machinery field making numerous purchases of appreciable size, although much of their buying is being confined to the equipment which is absolutely necessary. Garages are also placing some nice orders, especially for air pumps and accompanying equipment. The railroads are buying but little used machinery at present.

Inquiries for pig iron during the past week were noticeable, but buying was restricted to small lots, principally for early delivery. The coke market showed some improvement. Local foundries have fallen off somewhat in volume of production, but are operating on a large scale.

Indiana Preparing for Busy Fall

While there seems to be a lot of optimism among machine tool and machinery men in Indianapolis, actual volume of sales is not what was expected. It is true there has been the usual seasonal lull, which was expected. The prospects, however, are good and it is expected the Fall production will be better than Spring. There is a notable tendency toward closed cars, which should have some considerable effect on machinery and tool sales with the body corporations here.

During the past two weeks there have been many inquiries concerning special machinery for use in oil fields. Activity in the oil fields in the southern part of the state has been on the increase for some time and the sudden interest in machinery leads to the belief that new operations are contemplated. The one bright spot in the business comes from the lumber mills and construction industry. Demand for saws, mill machinery, and special tools for woodworking plants continues unabated and no respite is expected now until late Fall.

Another source of activity comes from the flour milling machinery field. From the volume of inquiries and actual business reported here, it would seem mills in all parts of the country are getting ready to take care of the big wheat harvest. While it will be weeks before actual milling of new wheat begins, the mills are getting ready for a rush of business.

Used machinery business is only fair. There does not appear to be a big stock on the market and it is certain the demand is not large.

Building Three Airships for Government

Work has been started at the plant of Airships, Inc., Hammondsport, N. Y., on three T. C. airships on a contract recently awarded by the Air Service, it is announced by the Aeronautical Chamber of Commerce of America.

The T. C. is the latest large sized training ship in use by the Air Service. it has a capacity of 200,600 cu.ft., a length overall of 195.81 ft., and a maximum diameter of 44.54 ft. The ships carry a crew of six men, and have a cruising radius of 1,630 miles at 47 miles per hour, and a maximum speed of 60 miles an hour, being powered with two Wright Type I engines, mounted on outriggers just forward of midships of the car. It is expected that all three of these ships will be delivered and in service within a year provided present plans are carried out as intended.

Chicago is Cheered by Fall Prospects

Sales of machine tools in the Chicago district during June were lighter than those reported during May. It is believed that the falling off of business during June is mainly due to the seasonal slump. Inquiries and sales were approximately 20 per cent over those during the same month last year, but are confined in the main to small orders.

While some business continues from the railroads, the bulk of inquiries are from manufacturers. There are still prospects of fairly sizeable railroad buying. Several dealers in used machinery report a satisfactory volume of sales. Inquiry is mainly for single tools. Specialized tools appear to predominate in many of the inquiries.

With considerable business pending dealers feel that prospects for new business in the near future are good. There are indications of fairly good sized orders from industrial users, a number of whom are making inquiry for small groups of equipment. Manufacturers in the metal trades are recovering from the slack period which began in May due to the falling off of orders and new business is making its appearance. The shortage of skilled labor is thought to have had a depressing effect upon general buying in the Chicago district, several concerns, because of labor shortage having been unable to operate at capacity.

The sales of agricultural machinery and equipment increased more than 10 per cent during May over the previous month, according to the Federal Reserve Bank of Chicago, which has just made public figures from 110 manufacturers in the Chicago district.

Chicago dealers have obtained considerable satisfaction from the prospects for new business which is in sight for the future as a result of plans just announced here for expansion of existing plants and also new plants.

Will Continue Central Station School

A very thorough course of instruction marked the third year of the Central Station School of Industrial Heating of the N. E. L. A. and the response met with among Central Station companies has been so encouraging that it is planned to continue the school in future years and to organize similar schools in the different geographic divisions of the association within the United States.

The courses this year were given by the Westinghouse Electric & Manufacturing Co. at East Pittsburgh and the General Electric Co. at Schenectady, N. Y., and included lectures on practically every phase of industrial heating and inspection trips to plants where heating installations had been made. The program was arranged by Wirt S. Scott of the Westinghouse companies, who is chairman of the Industrial Heating Division of the N. E. L. A. and who, in 1921, was the real originator of the whole idea of an industrial heating school. Mr. Scott also took personal charge of the class at East Pittsburgh and himself gave many of the lectures. Harold Fulwider of the General Electric Co. was in charge of the class at Schenectady.

News of Washington Activities

By Paul Wooton

THE most important single step toward stabilization in the coal industry was taken when the Interstate Commerce Commission abolished the railroad practice of assigning cars. It is pointed out, however, that the retention of this great advantage is dependent upon the attitude of the coal producers themselves. If advantage is taken of the situation to exact unreasonable prices from the railroads or if the railroads should be able to demonstrate that they cannot fuel themselves properly without assigned cars, as they have contended, the same body which has issued this order has the power to undo it. This victory for the coal operators was attained on a seven to four decision. Should two members of the Commission become convinced that this order is not working out properly, its revocation doubtless would be prompt.

There is no reason, however, to believe that the coal-producing industry is so lacking in vision as to attempt to gouge the railroads. From Sept. 1, the effective date of the order, the practice of buying coal with cars and with money will cease. Cars, private and otherwise, must be counted against the distributive share of each mine. It is just possible that the private car interests can delay the effective date by the securing of an injunction, but it is believed that the chance is small of securing an injunction which would endure during the life of the litigation, which it is reasonably certain the private car owners will bring. It is thought unlikely that the railroads will take the case to the courts.

Commissioners Hall and Daniels, in their dissenting opinions, simply argued the legal and technical points involved.

German Factories in Orient

While German chemical manufacturers are understood not to have abandoned the consideration of erecting factories in this country, it is known that they are rather dubious of the success of such a plan. The prospects of applying this policy to the Orient seem to impress the Germans as being more favorable. In the Orient they would have the advantages of cheap labor, a lower rate of taxation and would still have all of the advantages which go with their patents and secret processes. There, too, the German manufacturer would be less liable to lose his technicians and skilled employees to a competitor—one of the drawbacks to location in a country where a competitor would be likely to offer increased salaries to key men. By locating in the Orient a factory would be in the heart of a large consuming district, particularly were the product dye stuffs. The great objection to such a plan would be the difficulties of securing raw materials.

Many expressions of regret are heard because the plan to form a coal-tar export association apparently has failed. The failure of this proposal, it is pointed out, comes at a time when the interest in this type of organization is greater than ever before. Friends of the idea point to the fact that even in the case of silver—a commodity with various inherent disadvantages militating against association export—the coal tar exporters are allowing the plan to go by the board. There are now fifty-six operating export associations. The more recent ones have been formed by exporters of tires, naval stores, corn products, grain products and rubber goods.

The export association idea has not made great progress in the industries where a limited number of powerful concerns already have established export facilities. They naturally do not want to share any of their business with their competitors in this country.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.034	$0.034	$0.0252
Cold finished shafting	per lb	0.042	0.042	0.0335
Brass rods	per lb	0.1825	0.1913	0.155
Solder (½ and ½)	per lb	0.2862	0.2812	0.21
Cotton waste	per lb	0.1231	0.1231	0.101
Washers, cast iron (⅛ in.)	per 100 lb.	4.66	4.66	3.83
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.08	2.96	3.11
Lard cutting oil	per gal	0.575	0.592	0.575
Machine oil	per gal	0.349	0.349	0.34
Belting, leather, medium	off list	37%	37%	43%
Machine bolts up to 1x30 in.	off list	44¼%	44¼%	58%

Freight Cars Are in Good Condition

Fewer freight cars are now in need of repair than at any time since January, 1921, according to reports just filed by the carriers with the Car Service Division of the American Railway Association.

These reports showed that on June 15 this year 200,784 freight cars of various kinds or 8.9 per cent of the total number on line were in need of repair. This was a decrease of 10,982 since June 1, at which time there were 211,766 or 9.4 per cent.

Of the total number, 150,540 freight cars were in need of heavy repair, 5,024 less than on June 1. There were also 50,244 freight cars in need of light repair, which was a decrease of 5,958 compared with the number in need of such repair at the beginning of the month.

During the first 15 days in June, 1,280,277 freight cars were repaired and turned out of the shops. This was an increase of 102,320 freight cars over the number repaired during the preceding fifteen day period.

Philadelphia Business Exceeds Last Year's

Tool manufacturers in virtually all lines of manufacturing in Philadelphia are in need of men to meet the demand on their shops. What falling off there has been in the volume of business has been off-set by the shortage of skilled workmen.

Most of the tool manufacturers report business considerably in advance of this period of last year. There are no signs at this time of any great abatement, although some report fewer orders than was the case a few weeks ago.

Manufacturers of punch and die tools report the volume of inquiries concerning their product has not greatly lessened and orders are in to keep the shops busy. The production of hatchets and hammers is about thirty per cent ahead of this period last year.

The Metal Manufacturers Association reported all its shops are busy, with most of them needing men.

The monthly report of the Federal Reserve Bank of Philadelphia states that iron and steel products are not selling as well as they were. The general industrial situation is summarized with the statement that although orders are of smaller volume and are for prompt delivery, there is a feeling of optimism. The present lull is considered favorable for a sound business condition, as it enables many firms to make preparations for more active buying in the late summer and early fall.

Wholesale hardware is in greater demand, with building contractors the heaviest purchasers. Coal mines also are buying. The demand for gas and electric light fixtures has fallen off. Tinware manufacturers report an active business. A similar report comes from manufacturers of concrete mixers.

Wholesale lumber dealers report sales dull, but hope for contractors to finance building operations is bright.

Export Catalogs Should Be Registered

Many American exporters have been disappointed in finding that catalogs and important printed matter sent to foreign customers in certain countries have not reached their destination, states an editorial in *Commerce Reports* published by the Department of Commerce. In one country, for instance, where the cost of fuel is very high, an American business man found that the mail carriers were using his catalogs for fuel. In another section of the same country, where his catalogs had to be carried three miles to the factory of one of his customers, the mail carrier had thrown the catalogs away.

It therefore seems necessary to register important printed matter and catalogs in order to insure safe delivery in many countries. In most instances the printing of catalogs is expensive, and the extra outlay of 10 cents for registration in order to insure delivery seems to be money well spent.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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ANOTHER week has passed. None of the failures rumored or predicted have occurred. The markets have in a measure recovered their poise and one finds himself wondering why the financial world was for a time afflicted by a baseless hysteria of fear.

The answer seems to be that men are more alarmed by the unknown than the known and that the vague apprehension felt in Europe over the Anglo-Franco-German situation communicated itself to some bankers here whose gloomy silence was construed to mean more than they were willing to tell. But now that the worst is known it has lost its terrors and there is every reason to expect that normalcy will soon resume its sway in the Western World.

Briefly, this worst appears to be that Great Britain has decided to make her own settlement with Germany and leave France to do likewise. This naturally displeases the French and some nervous souls have suggested that the result might be war. Those who are willing to believe this are welcome, but the vast majority of men are likely to reject the idea as preposterous at least until the generation who fought the last great war are dead. There are nevertheless a few who shudder when they read that France is building many new airplanes and that Lord Derby has announced that there would be no further reduction in Great Britain's fighting forces for the present. Another effect of these belligerent gestures is a rise in the Bank of England rate which has been advanced from 3 to 4 per cent, while both francs and sterling have been very weak and marks are a little nearer zero.

On this side the Atlantic there has also been some tightening of the money market and rates are a shade higher as a result of the seasonal demand for credit that is always felt at the end of June. The reserve ratio of the Federal Reserve System is in consequence lower at 74.4 per cent as compared with 76.9 a week ago. The bills discounted have increased by $150,000,000, the circulation is up about $56,000,000 and the gold on hand has decreased by $23,000,000. This loss of gold probably represents yellow backs forced into circulation in pursuance of a questionable policy that may make it hard to recover them when our gold reserves need reinforcement.

The gold certificates or yellow backs in the hands of the public were increased by $36,140,000 between January 1 and June 1. Since the latter date another $36,000,000 has probably been distributed and the Federal Reserve Banks seem to be persistent in their efforts to get the gold out of sight lest being visible it may inflame speculation and bring about the inflation so much feared. Whether the cure is worse than the disease remains to be seen.

But it is at least reassuring to feel that since any undue distension has been prevented there is no likelihood of an acute contraction and that business is on a perfectly even keel as the harvest season opens and the crops are made ready for market.

Almost the only unsatisfactory feature of the outlook is the surplus supply of wheat. This year's crop is expected to exceed 800,000,000 bushels. With an estimated carry over from last year of at least 130,000,000 bushels there will be an available supply of nearly 1,000,000,000 bushels next fall. This is 200,000,000 bushels in excess of the probable demand for domestic consumption and export, and the problem of its disposition is a serious one.

> "The steel industry is working at full capacity, but prices for some shapes are slightly lower. Car loadings continue to beat previous records, but there are still some surplus cars and the prospect is for less congestion and a prompter traffic movement this Autumn. Railroad earnings are still increasing and the outlook is that the year 1923 will be the most prosperous in the history of the roads."

A demand that the Government shall buy it or finance it is already heard, but it is not likely to be granted and unless Europe can be put in a position to buy our superabundant production the result may be serious for the wheat producing states.

But the grain market is nevertheless reasonably steady upon the theory that in some way the farmer will muddle through and that the profit he is making on his corn and other crops will in a measure offset his loss on wheat.

The other commodity markets do not call for much comment. Cotton declined on a bearish Government report that will soon be forgotten and is already discredited by the recovery in prices since recorded. Sugar is unchanged. Coffee is gradually dropping to an investment level as it becomes evident that the Brazilian Government does not intend to support the market.

Rubber is easier. Copper is distinctly weaker at 14¼ cents, reflecting the economic importance of Europe, where the prewar consumption was so large. For similar reasons tin and lead are also lower. Pulp wood and paper are distinctly firm because the Canadian Parliament has passed a bill prohibiting the export of pulp wood from Canada. If the Governor General signs this bill, as expected, it will reduce the supply of pulp wood available for the United States by about 20 per cent.

The steel industry is working at full capacity, but prices for some shapes are slightly lower. Car loadings continue to beat previous records, but there are still some surplus cars and the prospect is for less congestion and a prompter traffic movement this Autumn. Railroad earnings are still increasing and the outlook is that the year 1923 will be the most prosperous in the history of the roads.

Retailers and jobbers are doing an exceptionally good business and the two leading mail order houses report startling increases in their sales.

Raw wool is steadier and woolen goods are in excellent demand. A between seasons hesitancy is reported by the wholesale houses in the cotton goods business, but the complaints come chiefly from those that represent the New England mills. Therefore it is not surprising to read that more Southern mills have been sold to Northern manufacturers.

In the security market there has been an improvement in the demand for the better class of bonds. This is the conventional precedent to an advance in stocks that will probably take place when the recent prophets of disaster again reverse themselves and the New York speculators stop saying they see ghosts on the other side the Atlantic.

Meantime the barometer is rising and the sea seems likely to remain smooth until it is again troubled by those who think, like King Canute, that they can control the tides because they have the power of the government behind them.

All Car Loading Records Are Broken

Despite the fact that loading of revenue freight has exceeded the million car mark for three consecutive weeks, a record unheard of at this season of the year in previous years, the number of surplus freight cars in good repair and immediately available for service continues to increase.

Surplus freight cars of all descriptions on June 22, the latest figures available, totaled 58,671 cars. This was an increase of 6,683 over the total on June 14. At the same time the reported shortage in freight cars, for the country as a whole, amounted to only 11,896 cars, or a decrease since June 14 of 891 cars.

Surplus box cars in good repair totaled 34,735, an increase in approximately a week of 4,875, while surplus coal cars numbered 4,269, or an increase during the same period of 1,140.

Pratt & Letchworth Co. Is Sold

Announcement was made recently of the sale of the Pratt & Letchworth Co., one of the oldest manufacturing plants in Buffalo, to the Dayton Malleable Iron Co., Dayton, Ohio. The Buffalo foundry will become a unit of the Dayton concern. The present officers of the company will be retained with John C. Bradley, chairman of the board of directors. Negotiations for the merger were completed last week, but the matter was not made public then.

The capacity of the Buffalo plant is 40,000 tons a year. Approximately 1,500 men are employed.

The Pratt & Letchworth Co. was founded in 1848 by Samuel F. Pratt, Pascal P. Pratt and William P. Letchworth for the manufacture of saddlery and carriage hardware. It was known at one time as one of the largest manufacturers of railroad castings in the country.

Personals

OTIS GROSS, New Philadelphia, Ohio, has been promoted to assistant superintendent of the New Philadelphia plant of the American Sheet & Tinplate Co., made vacant by the resignation of Elmer Griffith to become superintendent of a mill in Michigan. Gross has been identified with the local mill for several years and has been advanced from labor superintendent.

E. L. CHAPMAN, for many years representing the Davis Tool Co. in the Missouri district, has been appointed representative of the West Tool Co., Detroit, Mich., for the state of Michigan.

GEORGE H. GRUNDY has been appointed manager of steel sales for Peter A. Frasse & Co., New York City.

GEORGE G. EVERITT, for eleven years associated with the Eastern sales organization of the Whitman & Barnes Manufacturing Co., Akron, Ohio, with headquarters in New York City, has been made manager of the New York office and warehouse at Church and Chambers Sts.

WILLIAM S. MCGREEVY and KENNETH H. BARTLETT, receivers of the Seneca Falls Mfg. Co. Inc., Seneca Falls, N. Y., have announced that the plant where "Star" engine lathes and "Short-cut" lathes have been manufactured will be sold July 17 at a receiver's sale.

MATTHEW MANN of Cortland, N. Y., has been appointed manager of the Vitrified Wheel Co., Westfield, Mass. RUDOLPH J. HEIN has been appointed office manager. Both have for some time past been identified with the Maxf Grinding Co., Chester, Mass.

ERNEST WILDHABER, research engineer and mathematical expert of the Niles-Bement-Pond Co., New York, during the past three and one-half years, has severed his connection with the company, and maintains an office with his brother Max Wildhaber at 15 Moore St., New York.

CLARENCE S. SIEBERT, for a number of years with the Superior Sheet Steel Co., Canton, O., has joined the concern of Waldo, Egbert & McClain, Inc., Buffalo, as a special steel representative.

W. B. MCCRACKEN has been placed in charge of the Chicago offices of the Champion Engineering Co., Kenton, Ohio, recently opened at 431 South Dearborn St., in that city. Mr. McCracken has been many years in the crane business and until recently was connected with the operating department of the Champion Company.

STEPHEN MOLTRUP, of Beaver Falls, Pa., has retired as president of the Standard Steel Gage Co. and Frederick N. Beegle, president of the Union Drawn Steel Co., Beaver Falls, Pa., was elected to succeed him. Samuel Hanna will succeed Walter Moltrup as vice-president and Herbert May is the new treasurer. Mr. Moltrup is treasurer of the Moltrup Steel Products Co. and will devote his entire time to that company.

J. B. HILL has been appointed representative for Williams, White & Co., Moline, Ill., in the Detroit district, succeeding C. G. d'Ugglas who died recently. Mr. Hill is located at 623 Majestic Building.

W. J. LEIGHNER has been appointed works manager of the George Cutter Co., a subsidiary of the Westinghouse Electric & Manufacturing Co., located at South Bend, Indiana.

W. H. ROLINSON has resigned as manager of the interior lighting section of the merchandising department of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, and H. M. WIBLE, in addition to his present duties as manager of the rectifier section, is appointed manager of the interior lighting section. Mr. Wible will be located in the South Bend Works of the Company.

E. D. STEWART has been appointed branch manager of the El Paso office of the Westinghouse Electric & Manufacturing Co.

DR. A. S. MCALLISTER, engineer physicist, Bureau of Standards, who during the past two years has been liaison officer of the U. S. Bureau of Standards and the Federal Specifications Board, assigned to the headquarters of the American Engineering Standards Committee at New York City, has been recalled to Washington for special work, by Secretary Hoover of the Department of Commerce. DR. D. R. HARPER, physicist of the Bureau of Standards, has been assigned to the American Engineering Standards Committee succeeding Dr. McAllister. Dr. Harper is a graduate and former instructor of the University of Pennsylvania, and has been associated since 1909 with the Bureau of Standards.

MAX MAAG, Zurich, Switzerland, inventor of the gear system which bears his name and which is exploited in this country by Niles-Bement-Pond Co. arrived in the United States last week on a business trip.

W. B. CURRIER, JR., formerly general manager of the Cleveland Planer Co., Cleveland, Ohio, has severed his connection with that company and is now associated with the E. L. Essley Machinery Co., Chicago.

WILLIAM C. FRYE, for seven years president of the Chain Belt Co., Milwaukee, Wis., has retired from active participation in the affairs of the company and has been succeeded by C. R. MESSINGER who since 1917 has been vice-president and general manager.

WILLIAM BREEDEN has been appointed manager of steel sales for the Buffalo district for Peter A. Frasse & Co., New York. Mr. Breeden was formerly general manager of sales for the Lackawanna Steel Co., Lackawanna, N. Y.

SAMUEL M. VAUCLAIN, president of the Baldwin Locomotive Works, is receiving the sympathy of his many friends in his bereavement caused by the death of his wife.

H. J. BRADNER of the Lees-Bradner Co., Cleveland, Ohio, recently returned from a three months' business trip through England, France and Germany.

Obituary

JOHN ECKERT, president of the Milwaukee Forge & Iron Co., Milwaukee, died June 22 after an illness of six months. He was 44 years of age.

W. R. JOHNSON, chief engineer of the Colt Patent Firearms Manufacturing Co., Hartford, Conn., died suddenly as the result of an automobile accident that occurred while he was returning from a fishing trip July 2. Mr. Johnson's home was in Meriden, Conn.

WALTER C. SHOUP, age 48 years, president of the Autographic Register Co., New York City, died recently at his home, Short Hills, N. J., following a short illness.

WILLIAM E. MANNING, aged 53 years, vice-president in charge of sales of the Youngstown Sheet & Tube Co., Youngstown, Ohio, died recently in a hospital there. He was one of the best known men in the steel industry. He was born in Youngstown, the son of Dr. Henry Manning and member of a pioneer family there. He leaves a wife and one daughter.

PHILIP W. JONES, aged 62 years, superintendent of the Buckeye Rolling Mill, Newark, Ohio, died recently in the City hospital there. Mr. Jones had been engaged in the manufacture of steel in Youngstown for almost 40 years. He came to Newark from Toledo in May, 1910, when the Buckeye Rolling Mill was purchased and assumed the management of the plant.

Business Items

The Philadelphia Gear Works, 1120-1128 Vine St., Philadelphia, has opened a New York office at 50 Church St.

Permanent headquarters have been secured by the Whiting Corp., for its Birmingham, Ala., office. The new address is 1702 Jefferson Bank Building.

Fire, starting in the core room and pattern department of the Dayton Steel Foundry Co., Dayton, Ohio, caused a loss estimated at $100,000 on July 1. The blaze was discovered by the watchman at the Dayton Oxygen & Hydrogen Plant located nearby. The fire started in the southeast wing of the building. Company officials state that the plant will be rebuilt as quickly as possible.

S. F. Bowser & Co., Fort Wayne, Ind., recently celebrated the manufacture of the millionth self measuring gasoline pump that has been made by them.

The mechanical goods department of the Johns-Pratt Co., Hartford, Conn., has recently issued a locomotive chart upon which is presented a drawing of every part of a locomotive and a brief description of its function.

The July meeting of the New England Foundrymen's Association will be held at Hummocks, Hamilton, R. I., Thursday, July 12.

The Federal Trade Commission has dismissed its complaint against the M. T. K. Products Co., of Rochester, N. Y., for the reason that the charges of the complaint were not supported by the proof. The concern is a manufacturer of an abrasive bearing fitting compound, and in the complaint was charged with circulating misleading statements concerning a competitor's product.

August 15 has been tentatively set as the date when the plant equipment and other assets of the defunct Mitchell Motors Co., Inc., Racine, Wis., will be offered for sale by the trustee, Herbert F. Johnson of Racine. This is contingent upon the ability of the committee of appraisers to complete its work and file its report by July 15, the date that has been set.

The sale of the assets of the Winther Motors, Inc., of Kenosha, Wis., is scheduled to be held July 12 at the office and plant. Stockholders are considering a plan of reorganization framed by a committee of which Dr. E. W. Timm of Milwaukee is chairman.

The Empire Machinery Exchange Co., Inc., Cleveland, Ohio, has opened new and enlarged quarters at 2261 E. 14th St., Cleveland.

The Brightman Brothers Co. has been incorporated with a capital stock of $250,000, at Columbus, Ohio. The company will make hexagon steel bar nuts, shafting machinery and straightening machinery. The officers are: C. W. Brightman, president; G. F. Brightman, vice-president and treasurer; H. M. Brightman, vice-president; H. L. Brightman, secretary, and T. L. Brightman, assistant secretary.

The following officers have been elected by the Howell Electric Motors Co., Howell, Mich.: W. M. Spencer, president and treasurer; R. B. McPherson, vice-president; C. F. Norton, vice-president and general manager, and H. T. Proctor, secretary and assistant treasurer.

Unfilled orders for completion within one year were swelled to a valuation of $20,000,000 by receipt of contracts for ten switch engines of latest heavy type and design at the Lima Locomotive Works, Lima, Ohio. The engines are to be built for the Union R.R. of Pittsburg. Unfilled orders assure operation of the plant at maximum capacity.

The Pioneer Products Co., of Dayton, Ohio, has purchased the plant of the Bookwalter Wheel Co., Miamisburg, near that city.

At a recent meeting of the Electric Furnace Co., Salem, Ohio, the following officers were elected: F. T. Cope, general manager; R. F. Benzinger, Alliance, Ohio, manager of sales; George Lozier of Salem, Ohio, superintendent.

The firm known as the Hoosier Drilling Machine Co., Goshen, Ind., has been reorganized with additional capital stock and will henceforth be known as the Hoosier Universal Machinery Co. The organization will continue to manufacture drilling machines and drilling machine vises, and in addition will manufacture the Hoosier Spring Cushion Universal Joint and the Hoosier Factory Truck.

The Automotive Gear Works, Inc., a Delaware corporation, has qualified to do business in Indiana with a capital in that state of $100,000 preferred and 1,000 shares common, no par. It will manufacture machinery. Charles E. Hamilton of Richmond, is agent for the corporation.

The Anderson, Ind., Foundry & Machine Works will move into its new 100-ft. machine room addition next week. There will be no addition to the working force as a result of the occupancy of the new addition as the plant is now up to its full quota. The company has 160 workers. The new 100-ft. addition to the machine shop is equipped with a five-ton crane and other heavy machinery for the manufacture of oil engines.

Trade Catalogs

Tool and Cutter Grinding. The Norton Machine Co., Worcester, Mass. This excellently gotten up booklet has been issued to serve both as a handbook on tool grinding and as a catalog of the Norton universal tool and cutter grinding machines. The greater portion of the book is devoted to a discussion of cutter grinding in general and takes up the subjects of machines, wheels and procedure. Problems in cutter grinding are then treated, with illustrations and directions as to how to handle different types of work.

The catalog section of the booklet takes up the Norton machines, their uses and the ways in which they can be employed. Instructions are also given for setting up machines and for their proper handling. The booklet is 5x7 in. in size and contains 117 pages, being really a comprehensive treatise on the subject of tool and cutter grinding.

Electrical Supplies. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The new catalog for 1923 and 1924 has been issued by this company and is one of the most complete and attractive catalogs that has ever been issued. It contains 1,288 pages and is profusely illustrated with half-tones, line cuts, drawings and diagrams. There is much excellent descriptive matter to be found in this book and it makes a valuable addition to the shop library.

Belt Record Cards. Chicago Belting Co., Chicago, Ill. Cards 8x5 in. are being issued by this company and sent to users of belting in all parts of the United States. The cards are designed for the man who wants to keep an accurate record of his belts and the manner in which they are functioning.

Variable Speed Transmission. The Reeves Pulley Co., Columbus, Ind. Catalog T-44 has been issued by this company. It contains descriptions and illustrations of the many products that are made by the company and there is also a complete price list of transmission parts to be found in the back of the book.

Triplex Ammeter. Roller-Smith Co., New York. A folder describing the Triplex Ammeter for three phase A.C. circuits has been issued by this company. It tells the story of the product clearly and concisely. The folder is perforated on the left-hand edge so that it may be filed easily.

Foundry Sand Cutting Machines. The American Foundry Equipment Co., New York City. Sand cutting machines with large capacities and other features are shown in a folder that has recently been issued by this company. The machines are capable of cutting, mixing, cooling and piling sand in a remarkably excellent fashion and are now used by some of the largest foundries in the world.

Motors. The Jeannin Electric Co., Toledo, Ohio. Various types of motors that are made by this company are shown in a thirty-six page catalog that has been issued recently. The motors are all single phase repulsion induction motors and each part is clearly described and illustrated. The booklet also contains color work and diagrams that are useful to any shop.

Fuel Oil Burning Equipment. Combustion Engineering Corp., New York City. The many advantages that are claimed for oil as a fuel are set forth in an attractive booklet that has recently been published by this company. Diagrams, charts, graphs, tables and halftones are used with which to illustrate the descriptive matter.

Microgage. The Microgage Co., Boston, Mass. A booklet telling of the features of the microgage has been issued by this company. Absolute accuracy and ease of operation are two of the features brought forth.

Drop Hammers. Erie Foundry Co., Erie, Pa. Board drop hammers in sizes from 200 to 4,000 lb. are described in a folder that has been issued by this company. Specifications are also included in the circular.

Threading Machinery. Landis Machine Co., Waynesboro, Pa. An exceptionally well arranged catalog has been issued in which is described the various threading machines that are made by this company. The booklet has seventy-eight pages, is well illustrated and contains valuable information for machinery users.

Double End Lathe. Rockford Milling Machine Co., Rockford, Ill. A catalog describing the Sundstrand double end turning lathe and all of its specifications has been issued. Features not found on many similar machines are told of in this catalog.

Double End Drilling and Centering Machine. The Rockford Milling Machine Co., Rockford, Ill. A folder showing by illustration and descriptive text the advantages of this machine has been issued. Various parts and attachments are also shown.

Drill Jigs. George A. Gloor, Detroit, Mich. A four-page folder describing the Selfclamp drill jig has been issued by the maker.

Bushing Stock. The American Metal Products Co., Milwaukee, Wis. Castings made of Ampco metal are described in a folder recently issued.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Industrial machinery, especially oil well equipment and supplies. Buenos Aires, Argentina. Purchase and agency. Reference No. 7042.

Metals and bearings, anti-friction. Mulhouse, France. Agency. Reference No. 7015.

Tin-can making machinery. Guadalajara, Mexico. Purchase. Reference No. 6981.

Forthcoming Meetings

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Iron and Steel—June pig-iron output nearly as heavy as month preceding, despite hot weather. Third-quarter buying movement not developing according to expectations. Tendency shown to shade pig-iron prices to points but slightly above cost of production. Some concessions in steel quotations due to lower price of iron. Plates and shapes holding steadily at $2.50 per 100 lb. at mill, on majority of orders. Base price of bars, $2.40. Demand more active in plates and structurals during last week. Tank construction taking bulk of plates; railroad requirements still heavy.

Declines—Birmingham base on No. 2 foundry pig iron, quoted at $25 per gross ton, against $27. Visible tin supply decreased considerably; quotations down 1¼c. per lb. in New York during week. Lead down $3 per ton July 5; third decline in week, due to falling off in buying. Copper market weak but prices unchanged. Copper sheets and wire, washed white wiping cloths, red and white lead and lard cutting-oil declined in New York during week.

Advances—Stronger tone in zinc market; quotations advanced about 5c. per 100 lb. during week. No other advances reported.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29 05
Northern Basic	29.27
Southern Ohio No. 2	29.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.25
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.76
Virginia No. 2	32.17
Basic	28.26
Grey Forge	28.76
CHICAGO	
No. 2 Foundry local	30.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.51
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.77
Basic	27.77
Bessemer	29.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	6.75@7.40
Cincinnati	6.75
New York	5.50@7.00
Chicago	4.00@5.00

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21.	3.70	4.95	4.45	4.85
Nos. 22 and 24.	3.75	5.00	4.50	4.85
Nos. 25 and 26.	3.80	5.05	4.55	4.90
No. 28	3.85	5.15	4.65	5.00

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00	5.15	4.70	5.10
Nos. 12 and 14.	4.10	5.25	4.80	5.20
Nos. 17 and 21.	4.40	5.55	5.10	....
Nos. 22 and 24.	4.55	5.70	5.25	5.65
No. 26	4.70	5.85	5.50	5.80
No. 28	5.00	6.15	5.80	6.10

WROUGHT PIPE (Welded)—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Inches	Iron Black	Galv.
		BUTT WELD			
1 to 3	62	50½	¾ to 1¼	30	13
		LAP WELD			
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	60	49½	¾ to 1¼	30	14
2 and 3	61	50½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	5.00	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	7.35
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.30
Cold finished flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.32½
Soft steel bar shapes (base)	3.54	3.36	3.32½
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.71	3.40
Bar iron (3.25 at mill)	3.54	3.36	3.32½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8½c.; ⅛, 7.85c.; 3/32 to 1/16, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			38.37½
Lead (up to carlots), St. Louis	6.25	New York	6.72½
Zinc (up to carlots), St. Louis	5.85	New York	6.30

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	27.00	27.50
Antimony (Chinese), ton spot	8.00	10.00	8.25
Copper sheets, base	24.50	23.75@24.00	23.00
Copper wire (l.c.l.)	17.75	21.00	16.25
Copper bars (l.c.l.)	22.00	24.25	19.50
Copper tubing (l.c.l.)	27.00	29.25	23.00
Brass sheets (l.c.l.)	19.75	24.25	18.75
Brass tubing (l.c.l.)	25.50	29.75	20.50
Brass rods (l. c. l.)	18.00	21.00	15.75
Brass wire (l. c. l.)	20.25	22.00	.....
Zinc sheets (casks)	10.25	10.10	.....
Solder (½ and ½), (caselots)	31.50	29.50@31.50	20.00
Babbitt metal (83% tin)	56.00	49.00	40.00
Babbitt metal (35% tin)	30.00	17.00	16.00
Nickel (ingot and shot)	29.00	.....	35 00
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00
Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	12.00	12 00
Copper, heavy, and wire	13.25@13.75	11.50	11 00
Copper, light, and bottoms	11.25@11.75	9.50	10.00
Lead, heavy	5.00@ 5.50	5.00	5.75
Lead, tea	4.50@ 4.75	4.00	4.75
Brass, heavy, yellow	7.50@ 7.75	....	7.50
Brass, heavy, red	11.00@11.50	9.50	9.50
Brass, light	6.00@ 6.50	5.00	6 50
No. 1 yellow brass turnings	7.50@ 7.75	6.00	7.00
Zinc	3.75@ 4.25	3.00	3.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$19.50	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	12.60	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13¼x13¼, per lb.	10.75@11.00	36.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.13	1.27	1.28
White lead, dry or in oil	100 lb. kegs.	New York, 14.00	
Red lead, dry	100 lb. kegs.	New York, 14.00	
Red lead, in oil	100 lb. kegs.	New York, 15.50	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.50@5.00	
Coke, prompt foundry, Connellsville	per net ton	5.50@6.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅞ and smaller	60%	.....	...
Semi-finished nuts, ⅞ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ⅜ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ½ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, ⅞ in. dia. and smaller	40%	50-10%	60%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30-10%	30-10%	30-10%
Heavy grade	20-5-2½	30%	20-5-2½%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4 73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1 40
Cloth	3.38	2 67	3.20

New and Enlarged Shops

Machine Tools Wanted

D. C., Wash.—Bureau of Supplies & Accounts, Navy Dept.—receiving bids until July 17 for five electric grinders and two air compressors.

D. C., Wash.—A. L. Flint, Genl. Purch. Officer of the Panama Canal—receiving bids until July 18 for engine lathe, bench grinder, drill presses and embossing press.

Fla., Jacksonville—Jacksonville Engine & Machine Wks., 142 South Ocean St.—cylinder grinder.

Fla., Sandford—J. G. Leinecker—one 2 in. and one 3 in. capacity double bolt cutter.

Fla., Tallahassee—Tallahassee Iron Wks., R. O. Collins, Pres.—foundry and machine shop equipment, including lathe, drill press, welders, grinder, etc.

Ill., Chicago—Reliance Iron & Steel Co., 2133 South Sawyer St.—electric press for bundling steel sheet scraps.

Ind., Indianapolis—S. & B. Sheet Metal Wks., 930 Fort Wayne Ave.—sheet metal working machinery and equipment.

Kan., Cheney — Wallace-Blakely Motor Co.—power metal lathe (used).

Kan., Ellinwood—Hines & Koehler—8 ft. tinners' brake.

Kan., Ellinwood—A. Polzer (blacksmith)—power metal lathe.

Kan., Ellinwood—Stekel Lanteman Motor Co.—power lathe, drill press and emery stand.

Kan., Ellinwood—P. Wendell—power drill press and metal lathe for machine shop.

Kan., Great Bend—Dixon Tin & Battery Sta., 2014 Forest Ave.—lathe (used).

Kan., Great Bend—F. Richardson, 2009 Bway. (sheet metal work and plumbing)—power tread cutter machine.

Kan., Great Bend—Scranton Machine Shop—power metal lathe.

Kan., Great Bend—Used Car Exchange, L. Spruill, Purch. Agt.—power drill press, metal lathe and emery stand (used preferred).

Kan., Great Bend—Wells Bros. (blacksmith)—11 and 20 in. power lathes, drill press, hangers, pulleys, power emery stand, belting, bearings, cylinder grinder and shafting.

Kan., Hutchinson—Brown Cycle Co., 131 Sherman St., East, C. N. Brown, Purch. Agt.—power metal lathe.

Ky., Barbourville—J. M. Hinkle, Box 295—power metal lathe and screw machine for machine shop.

La., New Orleans — Blattman-Weeser Sheet Metal Wks., Inc., Burgundy and Toulouse Sts.—10 ft. power machine for cornice, corrugated iron and moulding work, 16 gauge capacity.

Mass., Roxbury (Boston P. O.)—H. B. Church Truck Service Co., 26 Reading St.—power winch for motor truck, drills, reamers, taps, dies, punches and other bench tools (used).

Mich., Detroit—Johnson Piston Ring Co., 6010 Woodward Ave.—miscellaneous machine equipment for the manufacture of piston rings.

Mich., Detroit—Lincoln Mfg. Co., 2630 Erskine St. (metal spinning and stamping)—one No. 1½ B Bliss toggle drawing press (used).

Mich., Dowagiac—J. Heddon's Sons (machine shop)—Brown & Sharpe automatic milling machine.

N. Y., Buffalo—Becker-Hoffman Service Co., Inc., 250 Franklin St.—equipment for proposed garage and repair shop at 133 South Elmwood Ave.

N. Y., Buffalo—D. E. Belden, 263 Carolina St.—garage and repair shop machinery, tools and equipment.

N. Y., Buffalo—F. J. Brinkworth, 154 Hodge Ave.—equipment, also one 1,000 gal. gasoline tank and pump for proposed automobile service station at 2089 Main St.

N. Y., Buffalo—W. P. Carey, 1579 Niagara St.—equipment for automobile service station, also one 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—P. C. Dwyer, Bailey Ave. and Highgate St.—gasoline and service station equipment, including pumps, tools, air compressor, etc.

N. Y., Buffalo—A. C. Eiss, 59 Gold St.—equipment for proposed garage and repair shop at 1420 William St.

N. Y., Buffalo—J. P. Gimbrone, 490 Niagara St.—equipment for automobile repair shop at 518 Niagara St.

N. Y., Buffalo—D. T. Kissinger, 1110 East Delevan Ave.—gasoline and service station machinery, tools and equipment, including air compressor, pumps, etc.

N. Y., Buffalo—W. H. Linford, 2082 Niagara St.—gasoline and service station machinery, tools and equipment.

N. Y., Buffalo—C. Liske, 1041 Genesee St.—equipment for proposed bicycle and motor cycle repair shop at 1037 Genesee St.

N. Y., Buffalo—B. Marshall, 394 Jefferson St.—equipment for automobile repair shop.

N. Y., Buffalo—W. McNeely, 80 Park St.—equipment, also one 1,000 gal. gasoline tank and pump for proposed automobile service station at 1605 Elmwood Ave.

N. Y., Buffalo—J. Orlando, 243 Seneca St.—equipment, also two 550 gal. gasoline tanks and pumps for proposed garage and repair shop at 223 Seneca St.

N. Y., Buffalo—A. Shabtag, 1553 Niagara St.—gasoline and service station machinery, tools and equipment, including air compressing outfit, etc.

N. Y., Buffalo—F. A. Van Dyke, 32 Edward St.—equipment for proposed garage and repair shop on Erie and Henry Sts.

N. Y., Buffalo — Whistler & Schanland, 1283 Niagara St. (manufacturers of tool dies)—Nos. 6 or 7 press, or similar.

N. Y., Long Island City—Stinzing Machine Shop, 250 4th Ave.—one Bliss power press, about No. 20.

N. Y., Jamestown—L. F. Swanson, 409 Washington St.—additional machine shop equipment.

N. Y., Malone—J. B. Hinds, 107 Catherine St.—vertical drill press and twist drill.

N. Y., New York—F. Streicher, 105 John St.—vertical milling machine for machine shop.

N. Y., Ogdensburg—B. A. Evans—two electrically operated gas pumps, air compressor with tank, lathe, drill press and miscellaneous motor repair tools for proposed garage and machine shop at Gouverneur.

N. Y., Rochester—Cullinan-Malcolm Co., 4322 Lake Ave.—additional garage and repair shop machinery and equipment.

N. Y., Rochester—V. Gavin, 109 Weyl St.—garage, repair and service station machinery, tools and equipment, including air compressor, pumps, etc.

N. Y., Westfield—Log Cabin Service Sta.—air compressor, gasoline and service station machinery, tools and equipment.

O., Cleveland—Midcontinent Producers & Refiners Corp., 619 Hanna Bldg.—equipment for gasoline and service station on Hayden Ave.

O., Cleveland—Natl. Refining Co., Natl. Bldg.—equipment for gasoline and service station on Detroit Ave., Lakewood.

O., Cleveland—Western Reserve Oil Co., 3706 Franklin Ave.—machinery, tools and equipment for gasoline and service station on Elmwood and Detroit Aves., Lakewood.

O., Columbus — Brightman Bros. Co., Markinson Ave., C. W. Brightman, Pres.—equipment, including two drill presses, two 24 in. lathes, several milling machines, etc., for new plant for the manufacture of nuts and shafting.

O., Euclid—C. A. Ashcraft—complete machinery, tools and equipment for Durant and Star service station at Wickliffe.

O., Painesville—Stanton Motor Co.—machinery, tools and equipment for large addition to Ford garage and service station.

O., South Columbus—Seagrave Co. (manufacturer of fire apparatus), C. S. Greenlee, Purch. Agt.—general equipment, including 24 in. lathe and one grinder, etc., to increase capacity of plant.

Ore., Portland—Office of United States Engineer, Custom House—receiving bids until July 20 for one 200 ton hydraulic wheel press and one 25 in. high speed back geared crank shaper.

Pa., Allentown—Pennsylvania Independent Oil Co., 4th and Linden Sts.—machinery, tools and equipment for new gasoline and service station.

Pa., New Brighton — Sampson & McBeth, c/o J. E. Martsoff—equipment for new garage and service station at Beaver Falls.

Pa., Phila.—J. Matlock, 518 North 32nd St.—power metal bench lathe for machine shop.

Pa., Pittsburgh—Bd. Educ., Fulton Bldg.—lathes, grinders, shapers, blowers, furnaces, drill presses and planers for Westinghouse High School.

Va., Richmond—Broad St. Bicycle Wks., 506 West Broad St.—drill press and welding outfit.

Va., Richmond—D. L. Claville, 906 East Cary St.—drill press, emery stand and welding outfit for automobile repair work.

Va., Richmond—J. C. Cocke & Co., 533 West Broad St. (watch maker)—small lathe.

Va., Richmond—Cornice Repair Shop, 313 North Smith St. (automobile repairs)—small lathe for metal work.

Va., Richmond—A. I. Fleming Welding Wks., 1623 West Broad St.—drill press and lathe.

Va., Richmond—C. W. Pennell, 711 West Broad St.—drill press for automobile repair work.

Va., Richmond—Seaboard Motors Co., 605 West Broad St.—arbor press and electric drill.

Va., Richmond—Supreme Motor Repair Co., 1631 West Broad St.—drill press and cylinder grinder.

Va., Richmond—Terrell Bros., 422 West Broad St. (watch maker and jeweler)—small lathe and bench tools.

Va., Richmond—Vaughn Motor Co., 114 West Broad St.—lathe, drill press, milling machine and reamer.

Wis., Appleton—Northern Boiler & Structural Iron Co., E. Kottke, Mgr.—machinery and iron working equipment, including drills, belting and shafting, for steel fabricating shop.

Wis., Beloit—J. R. Morash, 126 East Shirland Ave. (machinist)—one chain hoist, grinders, 22 in. drill press, belting and shafting.

Wis., Green Bay—Green Bay Fdry. & Machine Co., Arndt St. and South Bway., R. A. North, Mgr.—forges, machinery and equipment for new gray iron foundry and machine shop.

Wis., Green Bay—Sun Ray Heater Co., c/o A. E. Halterman—machinery and equipment for the manufacture of portable electric therapeutic devices.

Wis., Kiel—H. Daniels (machinist)—6 ft. lathe, chain hoist and shafting.

Wis., Marshall—Lazers & Sons Motor Co.—automobile repair machinery, drill press, small tools, gasoline storage tanks and pumps for garage at Waterloo.

Wis., Milwaukee—Badger Corp., c/o B. J. Reynolds, 915 Majestic Bldg. (manufacturer of automobile accessories, etc.)—tool room lathe, medium size drill press, emery wheel and stand.

Wis., Sturgeon Bay—G. Peterson—machine and assembly shop equipment, also belting and shafting for the manufacture of gas engine work stand fixtures.

Ont., Ottawa—Dept. of Justice, W. S. Hughes, Supt. of Penitentiaries—machinery for machine shop, also for carpentry department of penitentiary at St. Vincent de Paul, Que. (new).

Ont., Toronto—Mahaffy Iron Wks., 4 Trafalgar Ave. — equipment, including lathes, drills, etc., for proposed $50,000 factory.

Que., Chateauguay — M. D. Chevalier, Ville de Levy St.—equipment for garage on Wilson Ave., Montreal.

Que., Ste. Cesaire—Central Garage, Ltd., J. O. Brisbois, Purch. Agt.—garage and automobile repair equipment.

Que., Shawenegan Falls—J. Perreault, 68 Champlain St.—machine shop equipment.

Que., Three Rivers—L. Alarie, St. Antoine St.—garage and automobile repair shop equipment.

Que., Vercheres—Larose & Frere—garage and automobile repair shop equipment.

Machinery Wanted

Ala., Citronelle—City Council—ice manufacturing machinery and equipment.

Ala., Dothan—H. C. Forrester—complete ice manufacturing machinery and equipment.

Ala., Eufaula—J. D. Schaub & Co.—8 x 12 in. Chandler & Price power job printing press, also paper cutter.

Ala., Fort Payne—W. B. Davis & Sons—machinery and equipment for $150,000 plant for the manufacture of hosiery at Tuscaloosa.

Ark., Camden—T. D. Fooks—lumber mill machinery and equipment, including saws, planers, transmission and conveying machinery, etc.

Calif., San Francisco—Main Iron Wks., 16th and Daggett Sts.—stake riveters.

Colo., Denver—Blayney-Murphy Packing Co., Union Stockyards—machinery for proposed packing plant.

Del., Wilmington—Arizona Klondike Gold Mines Co., 7 West 10th St.—gold smelting and refining machinery and equipment.

Fla., Jacksonville—F. G. Russell, 40 Riverside Ave. — complete foundry equipment.

Fla., Seffner — J. S. Parkerton — rock crushing machinery and equipment, 100 ton capacity.

Ga., Savannah—Southern Cotton Oil Co., 204 East Bay St.—machinery and equipment for $75,000 cotton oil plant.

Ind., Miami—Bd. Educ.—complete vocational equipment for $100,000 school.

Kan., Cheney—Cheney Sentinel, K. Cox, Purch. Agt.—power job press.

Kan., Cheney—E. E. Strohmeyer (harness shop)—power stitcher for leather work.

Kan., Ellinwood—Bills Cleaning & Tailoring Wks., W. Saitken, Purch. Agt.—cleaning extractor, belting, hangers, pulleys, bearings and shafting.

Kan., Ellinwood—Digen Harness Shop—power leather stitcher and finisher.

Kan., Great Bend—Great Bend Printing Co., C. E. Howell, Purch. Agt.—power paper cutter.

Kan., Great Bend—J. H. Weber (cabinet maker)—power scroll saw, wood lathe and sander.

Kan., Hutchinson—Golden Rule Press, C. Hood, Purch. Agt.—power paper cutter, also Miller feeder attached to power job press (used preferred).

Kan., Hutchinson—H. Robert, A St. (job printer)—power paper cutter.

Ky., Louisville—Office of United States Engr., P. O. Box 72, E. F. Kanzler, Purch. Agt.—one oxyacetylene welding torch, non flash back type with oxygen and acetylene regulators, gauges and two 12½ ft. sections of hose.

La., New Orleans—Bd. of Port Comrs., Room 200, New Court House—air compressor and receiver for grain elevator.

Me., Portland—Brown Co.—peanut packing machinery and equipment for plant at Palm Beach, Fla.

Mass., Campello (Brockton P. O.)—Howard Print, Inc.—14 x 22 in. Universal printing press with motor (used).

Minn., Holloway—A. P. Wells (job printer)—22½ in. power paper cutter.

N. J., Bloomfield—Combination Rubber Mfg. Co., Franklin Ave.—tire building and rubber working machinery and equipment for 4 story plant.

N. Y., Adams—A. Fuller Co., Box 125 (manufacturer of cane and willow furniture)—double surface planer and electric sanding machine.

N. Y., Bemus Point—Long Point Service Sta., C. B. West, proprietor—air compressor and other equipment for gasoline and service station.

N. Y., Buffalo—DuPont Fibre Silk Co., River Rd.—fibre silk looms and machinery for $400,000 plant at Nashville, Tenn.

N. Y., Buffalo—Tifft Lumber & Mill Supply Co., 345 Tifft St.—carpenter shop machinery, tools and equipment.

N. Y., Canastota—Watson Truck Corp., R. H. Imhofe, Purch. Agt.—spoke turning machines.

N. Y., Jamestown — Amer. Salvage & Housewrecking Co., Washington and 17th Sts., W. C. Hyer, Mgr.—brick cleaning and sawmill machinery and equipment, including saws, planers, transmission and conveying machinery.

N. Y., Jamestown—Black Belt Corp., 15 East 15th St., F. A. Ochs, Mgr.—machinery and equipment for addition to plant for the manufacture of leather belts.

N. Y., Jamestown — Efficiency Garage, Inc., 212 Washington St., O. Johnson, Mgr.—tire repair machinery, tools and equipment, including tire changing tool and vulcanizing outfit.

N. Y., Jamestown — Himbaugh Bros., Jones St. and Gifford Ave. (manufacturer of furniture)—complete machinery and equipment for dry kiln.

N. Y., Medina—The Tribune—linotype.

N. Y., Watts Flats—Southern Tier Milk Products Co., Inc.—dairy machinery and equipment.

N. C., Bakersville — Bakersville Roller Mills—ice manufacturing machinery and equipment.

N. C., Hickory—Hickory Chair Mfg. Co.—woodworking machinery and equipment, to replace that which was destroyed by $125,000 fire.

N. C., Littleton—E. E. Wollett & Son—6 x 15 high speed planer and edger.

N. C., Lumberton—Bd. Educ.—vocational equipment, including lathe, press, drill, small machine tools, etc., for $150,000 school.

N. C., Raleigh—Bd. Educ.—complete vocational equipment for $125,000 school.

O., Cleveland—County Comrs., c/o R. J. Lander, Surveyor, Cuyagoha County Court House—ice machine for county morgue.

O., Columbus—Hann & Adair Printing Co., 48 East Long St., C. Wilson, Pres.—composing room equipment and several presses to enlarge plant.

O., Ironton—Ironton Stove & Mfg. Co.—foundry equipment.

O., Napoleon—J. V. Scherer—10 x 15 in. power job press, Chandler & Price preferred.

O., Wellston—Wellston Mfg. Co.—complete foundry equipment (new).

Pa., Allentown—Allen Laundry Co., 41 North 10th St.—additional laundry machinery and equipment.

Pa., Catasauqua—Davis & Thomas Co.—foundry equipment.

Pa., Corry—B. & B. Mattress Co.—machinery and equipment for new mattress factory.

Pa., Freeland—Barnes Fdry. Co.—foundry equipment for plant at Jersey City, N. J.

Pa., Jamestown—Crescent Tool Co., Foote Ave. and Harrison St.—presses and pickling equipment.

Pa., Littlestown—Keystone Cabinet Co., H. H. Rose, Mgr.—machinery and equipment for plant for the manufacture of kitchen cabinets.

Pa., Marietta—Natl. Castings Co.—foundry equipment.

Pa., Oil City—United Natural Gas Co.—machinery and equipment for plant for the manufacture of charcoal.

Pa., Pittsburgh—A. M. Byers Co., Water St. (pipe)—charging machines and other equipment.

Pa., Sharon—Sharon Coal & Supply Co., 305 South Dock St.—coal handling machinery and equipment.

Pa., Warren—C. Zerres—handling and ice plant machinery and equipment.

Pa., West View (Pittsburgh P. O.)—Bd. Educ. — vocational equipment, including lathe, press, drill, etc., for $100,000 school.

S. D., Bowdle—Pioneer (newspaper)—power perforator and slug casting machine.

Tenn., Bristol—Cortrim Lumber Co.—machinery and equipment for proposed $50,000 addition to lumber and planing mill.

Tenn., Millington—Bd. Educ.—vocational equipment, including lathe, drill press, machine tools, etc., for $75,000 school.

Tenn., Rockwood—Roane Iron Co., Chamberlain Bldg.—iron casting machinery and equipment.

Tex., Breckenridge—J. W. Lancaster—laundry machinery, belting, hangers, pulleys, bearings and shafting.

Tex., Dallas—R. H. Baldridge, 528 Interurban Bldg.—100 cu.ft. air compressor and engine.

Tex., Fort Worth—Smith Bros. Grain Co., 6th and Pecan Sts.—machinery for proposed $100,000 grain elevator.

Tex., San Marcos—The Record—Miller feeder with job press, 12 x 18 in.

Va., Richmond—E. C. Meyer & Co., 3 West Broad St. (jewelry and watch repairing)—small lathe and gold refining outfit. Estimated cost $800.

Va., Richmond—Natl. Tire & Rubber Co., 452 West Broad St.—air compressor and vulcanizing outfit.

Va., Richmond—Parker Bros., 527 West Broad St.—air compressor and bench tools for automobile repair shop.

Va., Richmond—A. Reeves, 311 West Broad St. (barber supplies, grinding and polishing)—grinding machinery, emery wheel and stand.

Wash., Puget Sound—Bureau of Yards & Docks, Navy Dept., Wash., D. C.—receiving bids until July 18 for electric traveling bridge crane for navy yard, here.

W. Va., Clarksburg—Bd. Educ.—equipment, including saws, planers, drill press, lathe and machine tools for $75,000 vocational school.

Wis., Abrams—Abrams Creamery Co.—power churns, separators, testing machine, shafting and hangers.

Wis., Appleton — Badger Printing Co., Adkins St., D. Smith, Pres.—$12,000 worth of machinery, including Miehle press, paper cutter, monotype machine, etc., for propuosed addition to printing plant.

Wis., Belgium—Krier Preserving Co.—special canning machinery for proposed $40,000 plant, to replace that which was recently destroyed by cyclone (new).

Wis., Brillion—J. A. and F. H. Fuhrman—cheese making machinery, belting, shafting and vats for proposed $35,000 factory at Iron River.

Wis., Cuba—Connecting Link Mining Co., C. M. Treat, Secy.—crushing machinery, hoists, belting and shafting for proposed $40,000 mill.

Wis., Cuba—Scott-Sellick Co.—mining machinery, equipment, hoists, belting and shafting for proposed $50,000 wet mill.

Wis., Cudahy—Helmholz Shoe Mfg. Co., Packard Ave., W. Helmholz, Purch. Agt.—siding, eyelet and vamping machines.

Wis., Green Bay—Oneida Mfg. Co., L. W. Melcher, Mgr.—shop equipment, drills, small tools, etc., for the manufacture and repair of machinery and mechanical appliances.

Wis., Madison — State Bd. of Control, Capitol Bldg., F. Crocker, Secy.—ammonia refrigeration plant, ice machine and dishwashing machinery for refectory at Union Grove.

Wis., Merrill—G. B. Cotter—sixteen steam operated excelsior cutting machines, belting and shafting for proposed $50,000 factory.

Wis., Milwaukee—Brookshire Cheese Co., c/o N. F. Petrie, 709 Caswell Block—power churns, belting, shafting and vats.

Wis., Milwaukee — Retailers' Tallow & Calfskin Assn., c/o J. Herman, 2322 State St.—special machinery, belting and shafting for propsed $50,000 rendering plant.

Wis., Milwaukee—E. Seeger, 382 10th St.—emery wheels, hangers, belting, shafting and pulleys.

Wis., Milwaukee—J. Zirwes, 673 Dover St. (carpentry and woodworking)—one standard size Universal woodworking machine, to include planer, rip saw, cross cut saw and sticker.

Wis., Shawano—E. H. Kuester—mangles, washers, driers, etc., for proposed $40,000 laundry.

Wis., Whitewater—Metal Toy Wks., C. Schmiers, Mgr.—machinery, woodworking and small tools for the manufacture of metal toys and novelties (new and used).

Man., St. Boniface — Dominion Tar & Chemical Co., Ltd., L. O. P. Walsh, Vice Pres.—complete equipment for distillery, also three storage tanks.

Man., St. Boniface—A. Murray & Co., Ltd., c/o L. O. P. Walsh, Vice Pres.—complete equipment for the manufacture of roofing pitches, tarred and asphalt felts, building papers and other tar products.

Ont., Alexandria—Wicker Co. Ltd., M. Larocque, Purch. Agt.—equipment for the manufacture of wicker goods.

Ont., Corbyville—Industrial Alcohol Co.—equipment for alcohol plant, to replace that which was destroyed by fire.

Ont., Hespeler—Woodworking Co.—woodworking machinery, including saws, planers, shapers, etc., electric power.

Ont., London—Bd. Educ., E. Smith, Chn. Vocational Com.—tools and equipment for mechanical trades department of proposed $120,000 addition to technical school.

Que., Joliette—Pelland & Freres, J. Pelland, Purch. Agt.—additional machinery for sash and door factory.

Que., Montreal—Brandram Henderson, Ltd., 2984 St. Urbain St.—complete equipment for enamel and varnish plant.

Que., Montreal — Strathcona Potteries, Ltd., c/o Crankshaw & Chevalier, McGill Bldg.—machinery and equipment for the manufacture of pottery, wares and earthenware.

Que., Montreal—Triad Co., Ltd., c/o L. Fitch, 83 Craig St., W.—equipment for the manufacture of leather goods, boots and shoes.

Que., Outremont—La Compagnie de Cement Unie, Ltd., c/o F. Callaghan, 430 Wiseman Ave.—cement making and quarrying machinery.

Que., St. Jerome — A. Phaneuf — woodworking machinery.

Que., St. Maurice—O. Lamothe—bandsaw and additional equipment for sawmill.

Que., Shawenegan Falls—J. A. Bourassa—sawmill machinery.

Que., Shawenegan Falls—J. J. Ermond (pattern maker)—woodworking machinery.

Que., Shawenegan Falls — C. Gingras, Cedar Ave.—additional equipment for sash and door factory.

Que., Sillery—Quebec Pulp & Paper Co., Ltd.—groundwood pulp mill equipment, capacity 100 ton per day.

Que., Upton—L. O. Donais & Fils—additional sawmill equipment.

Metal Working Shops

Ark., Camden — O. B. Burns (Hudson dealer) awarded the contract for the construction of a 2 story, 50 x 110 ft. garage on Adams and Jackson Sts. Estimated cost $40,000.

Calif., San Francisco—L. R. Lurie, 315 Montgomery St., is having plans prepared for the construction of a 1 story garage on 7th and Bryant Sts. Estimated cost $40,000. O'Brien Bros., Inc., 315 Montgomery St., Archts. Pickwick Corp. and Pacific Auto Stage Lines, 3730 Mission St., San Francisco, lessee.

Calif., San Francisco — Williams Bros. Aircraft Corp., 1211 Van Ness Ave., is having plans prepared for the construction of a 2 story, 100 x 200 ft. factory on 25th St. between Potrero Ave. and Utah St. Estimated cost $40,000. R. R. Irvine, 736 New Call Bldg., San Francisco, Archt.

Calif., South San Francisco—The Metal & Thermit Corp. awarded the contract for foundations, grading, etc., for proposed factory. Estimated cost $80,000. Noted May 17.

Calif., Stockton—The Davis-Heller-Pearce Co., Delta Bldg., will build a 2 story, 100 x 100 ft. garage and automobile sales building on American and Channel Sts. Estimated cost $80,000. Studebaker Agency, Miner Ave. and Sutter St., Stockton, lessee.

Conn., East Hartford (Hartford P. O.)—D. B. Roberts, 275 Connecticut Blvd., plans to build two 3 story salesrooms and garages. Estimated cost $40,000 each. Engineer or architect not selected.

Conn., Hartford—A. R. Blumenthal, 299 Grafield St., is having plans prepared for the construction of a 2 story, 120 x 120 ft. garage, etc., on Morgan St. Estimated cost $60,000. B. A. Sellew, 721 Main St., Hartford, Archt.

Conn., Middletown—B. Williams, 34 Silver St., South Farms (Middletown P. O.), awarded the contract for the construction of a 1 story, 90 x 90 ft. garage on Center St. Estimated cost $40,000.

Conn., Plantsville — The Walker Stuart Fdry. Co., Summer St., plans to build a 2 story factory. Cost will exceed $40,000. Engineer or architect not selected.

Ky., Louisville—E. Straus, 4th and Market Sts., plans to build a plant for the manufacture of store and office fixtures on Baxter St. and Hamilton Ave. Estimated cost $200,000. Engineer or architect not selected.

La., New Orleans—H. M. Field awarded the contract for the construction of a garage on Howard Ave. and Carondelet St. Estimated cost $40,800.

La., New Orleans—The Todd Eng. Dry Dock & Repair Co., South Peters and Howard Sts. has had plans prepared for the construction of two warehouses and shop buildings. Estimated cost $60,000 each. W. E. Hart, c/o Enterprise Electric Co., 826 Baronne St., New Orleans, Archt.

Minn., St. Cloud—A. Peter and A. J. Durupt plan to build a 2 story, 66 x 150 ft. garage. Estimated cost $40,000.

Mo., St. Louis—The Pevely Dairy Co., 1001 South Grand Blvd., awarded the contract for the construction of a 2 story, 150 x 170 ft. garage on Chouteau St. Estimated cost $100,000.

Mo., St. Louis—The St. Louis-San Francisco R.R., 900 Olive St., awarded the contract for the construction of 1 story repair shop, 20 stall roundhouse, power house, machine shop, mill shop, store room, etc., on Fyler Ave. Estimated cost $500,000. Noted June 7.

N. Y., Glendale (Brooklyn P. O.)—The Osbruck Realty Co., Inc., 2332 Myrtle Ave., Ridgewood, (Brooklyn P. O.), will build a 1 story, 102 x 186 ft. garage by separate contracts under architect's supervision, on Pansy St. south of Central Ave., here. Estimated cost $40,000. H. C. Brucker, 2541 Myrtle Ave., Ridgewood (Brooklyn P. O.), Archt.

N. Y., Yonkers—The Otis Elevator Co., 11th Ave. and 26th St., New York City, awarded the contract for the construction of a 5 story, 90 x 145 ft. addition to its plant, here.

O., Cleveland—The Euclid-66th Co., c/o J. J. Klein and G. B. Harris, Engineers Bldg., awarded the contract for two 2 story, 75 x 100 ft. and 80 x 110 ft. automobile sales and service buildings at 6604 Euclid Ave. Estimated cost $150,000. Noted July 5.

O., Cleveland — L. J. Hostetter, 10803 Earle Ave., has had plans prepared for the construction of a 1 story, 50 x 127 ft. garage at 2024 East 70th St. Estimated cost $40,000. J. H. Graham & Co., 8201 Cedar Ave., Cleveland, Archts.

O., Cleveland — The Lees-Bradner Co., 6210 Carnegie Ave. (gear cutting), is receiving bids for the construction of a 1 story, 55 x 100 ft. and 30 x 100 ft. machine shop and storage building. Estimated cost $50,000. E. J. Lees, Pres. W. J. Wefel, Union Bldg., Cleveland, Archt. Noted July 5.

O., Cleveland—M. Rubin, c/o A. F. Janowitz, Archt., Standard Theatre Bldg., is having plans prepared for the construction of a 1 story garage on Lakefront and Hartshorn Rds. Estimated cost $40,000.

O., Cleveland—H. S. Thomas, c/o Stutz Motor Co., 4310 Carnegie Ave., plans to build a 1 story addition to garage and salesroom on a 66 x 186 ft. site at 4211 Carnegie Ave. Estimated cost $50,000. Engineer or architect not selected.

O., Euclid—K. F. Spietl, 3439 East Scarborough Rd., Cleveland Heights (Warrensville P. O.), has had plans prepared for the construction of a 1 story, 40 x 100 ft. commercial building and garage, here. Estimated cost $40,000. A. C. Wolf & F. M. Griffith, Swetland Bldg., Cleveland, Archts.

O., Sycamore—The Blu Bar Mfg. Co. plans to rebuild its plant for the manufacture of children's vehicles, etc. Estimated cost $50,000. Engineer or architect not announced.

Ore., Portland—The Oregon-Washington Ry. & Navigation Co., Wells Fargo Bldg., plans to spend $181,825 for shops and tools. G. H. Robinson, Purch. Agt.

Pa., Neville Island (McKees Rocks P. O.)—The Dravo Contg. Co., Diamond Bank Bldg., Pittsburgh, will build a 1 story, 75 x 273 ft. structural shop, here. Estimated cost $75,000.

Pa., Orangeville — Orangeville Brick & Sheet Products Co.—brick making machinery and equipment for proposed $100,000 plant.

Pa., Rankin (Braddock P. O.) — The Acheson Mfg. Co. (plumbing) is having plans prepared for the construction of a 1 story, 100 x 200 ft., 80 x 150 ft. and 100 x 150 ft. steel factory. Estimated cost $150,000. Private plans.

Tenn., Memphis—The City, C. C. Pashby, Clk., will soon award the contract for the construction of a 1 story shop building. Jones & Furbringer, Porter Bldg., Memphis, Archts.

Tex., Tremble (Fort Worth P. O.)—The Texas & Pacific R.R., Union Sta., Fort Worth, is having plans prepared for the construction of shops, roundhouses, etc., here. Cost will exceed $500,000. E. F. Mitchell, Texas & Pacific Bldg., Dallas, Ch. Engr.

Wis., Janesville — The Chevrolet Motor Co. is having plans prepared for the construction of a 1 story, 90 x 288 ft. factory. Estimated cost $100,000. C. E. Wilson, c/o owner, Archt.

Wis., Madison—The Schmidt Bros. Co., c/o A. J. Schmidt, 2611 Monroe St., will build a 1 story, 60 x 125 ft. garage and repair shop. Estimated cost $40,000. Noted July 5.

Wis., Madison—Small & Fladd, Archts., Ellsworth Bldg., are receiving bids for the construction of a 1 story, 60 x 87 ft. garage for the Madison Ford Garage, 210 East Washington Ave. Estimated cost $40,000. L. F. Schoelpopf, Mgr. Noted June 21.

Wis., Milwaukee—R. L. J. Clark, 2218 Meinecke Ave., awarded the contract for the construction of a 2 story, 100 x 140 ft. garage on 20th St. Estimated cost $60,000. Noted Feb. 8.

Wis., Milwaukee—The Modern Auto Repair Co., 2431 State St., will soon award the contract for the construction of a 1 story, 110 x 125 ft. addition to its garage. Estimated cost $50,000. H. T. Schramek, 808 South Pierce St., Milwaukee, Archt.

Wis., Racine—The Amer. Skein & Fdry. Co., 23rd and Racine Sts., awarded the contract for the construction of a 2 story, 42 x 140 ft. foundry. Estimated cost $40,000.

ADDITIONAL OPPORTUNITIES

Equipment
Business

Employment
Miscellaneous

See the

SEARCHLIGHT SECTION

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